

National Railroad Passenger Corporation



Electrical Operating Rules and Instructions

Introduction

These rules and instructions are issued for the protection of all personnel working, property, assets, equipment and operation of trains and locomotives in Amtrak's Electric Traction System. These rules and instructions meet or exceed established standards and regulations including but not limited to:

- National Electrical Code (NEC)
- Code of Federal Regulations:
 - Title 29 Occupational Safety and Health Administration (OSHA)
 - Title 49 Chapter 2 Federal Railroad Administration (FRA)
- National Fire Protection Association (NFPA)
- American National Standards Institute (ANSI)
- InterNational Electrical Testing Association (NETA)

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Table of Contents

Electrical Operating Rules and Instructions	0
Introduction.....	1
1. General Instructions for All Personnel	4
1.1 Safety	4
1.2 Emergency Conditions	6
1.3 Required Books and Publications	10
1.4 Training	11
1.5 Job Briefings.....	12
1.6 Communication	13
1.7 Minimum Approach Distances	14
1.8 Electrical Equipment.....	15
1.9 Roadway Maintenance Machines and Construction Equipment	16
1.10 Bonding and Grounding	17
1.11 Impedance Bonds and Rail Return System	18
1.12 Third Rail	21
1.13 Batteries	22
1.14 Generators/Inverters	23
1.15 Switch Heaters	24
1.16 Use of Approved Barriers	25
1.17 Electrical Switching and Tagging	27
1.18 Use of Live-Line Tools	28
1.19 Use of Electrical, Voltage Sensing and Verification Devices	29
1.20 Catenary Isolation Procedure.....	30
1.21 Electrical Clearance Procedure.....	31
1.22 Work Permit Procedure	32
1.23 Third Rail DC Power Permit Procedure	33
2. Rules and Instructions Pertaining Transportation Activities	34
2.1 Train Movement	34
2.2 Signal Aspects and Indications	35
2.3 Pantograph Operations	37
2.4 Planned Signal Interruptions	39
2.5 Catenary or Third Rail Power Outages	40
2.6 Pantograph Inspection and Damage.....	41
2.7 Inspecting for Catenary or Third Rail Damage.....	43
2.8 Sleet/Extreme Weather Instructions.....	44
2.9 Electric Power Restrictions	45
2.10 Plate Order	46
3. Rules and Instructions Pertaining to Mechanical Activities	49
3.1 Electric Engines.....	49
3.2 Mechanical Facilities	51
3.3 Head End and Wayside Power	52
4. Rules and Instructions Pertaining to Electric Traction Activities	53
4.1 General.....	53
4.2 ET Components	55
4.3 Control Houses and Remote Terminal Unit (RTU) Huts	56
4.4 Line Work	57
4.5 Substation / Frequency Converter Work.....	58
4.6 Capacitors	60
5. Rules and Instructions Pertaining to Power Directors and Load Dispatchers.....	61
5.1 General.....	61
5.2 Orders and Directions	62
5.3 Operation of Electrical Devices	63
5.4 Issuing Power.....	64
6. Contact Numbers.....	65
1) Amtrak Emergencies.....	65
2) C&S Trouble Desk.....	65
3) Train Dispatchers, Operators, etc.	65
4) Power Directors and Load Dispatchers.....	66
5) Foreign Utility Emergency Contact Information	67
7. Electric Traction Systems Locations, Nominal Voltage and Frequencies	68

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1) Transmission System	68
2) Overhead Catenary System	69
3) Signal System	69
4) Third Rail System	69
5) Wayside & Head End Power System	69
8. Tracks Equipped for Electrical Operation	70
1) Tracks Equipped for AC Electrical Operation	70
2) Tracks Equipped for DC Electrical Operation	71
9. Minimum Approach Distances	72
1) AC Minimum Approach Distances	72
2) DC Minimum Approach Distances	72
10. Phase Break and Dead Section Locations	73
1) Dead Section Locations	73
2) Phase Break Locations	73
3) Position Light Phase Break Indicator Location	73
11. Glossary	74
12. Illustration of Forms	105
12.1 Do Not Operate Tag - Red Tag (NEC 105)	105
12.2 Inspected and Approved Barrier Tag – Green Tag (NEC 101)	106
12.3 Plate Order Form (NRPC 2990)	107
12.4 Do Not Operate – Plate Tag (NEC 106)	109
12.5 Electric Traction Power Clearance Form (NEC 260)	110
12.6 Electric Traction Power Director Clearance Form (NEC 84)	112
12.7 Electric Traction Power Director Clearance Transfer Extension Form (NEC 84.E)	114
12.8 Electric Traction Employee Electrical Work Permit Form (NEC 261)	116
12.9 Electric Traction Power Director Electrical Work Permit Form (NEC 85)	117
12.10 Electric Traction Third Rail DC Power Permit Form (NEC 3285)	118
12.11 Electric Traction Power Director Third Rail DC Power Permit Form (NEC 70A)	120
12.12 Electric Traction Power Director Third Rail DC Power Permit Transfer Extension Form (NEC 70.E)	122
12.13 Electric Traction Employee LIRR Third Rail DC Log Form (NEC 3499)	124
13. Suggestion Page	126
14. Tables, Figures and Referenced Publications	127
List of Figures	127
List of Tables	129
List of Reference Publications	130

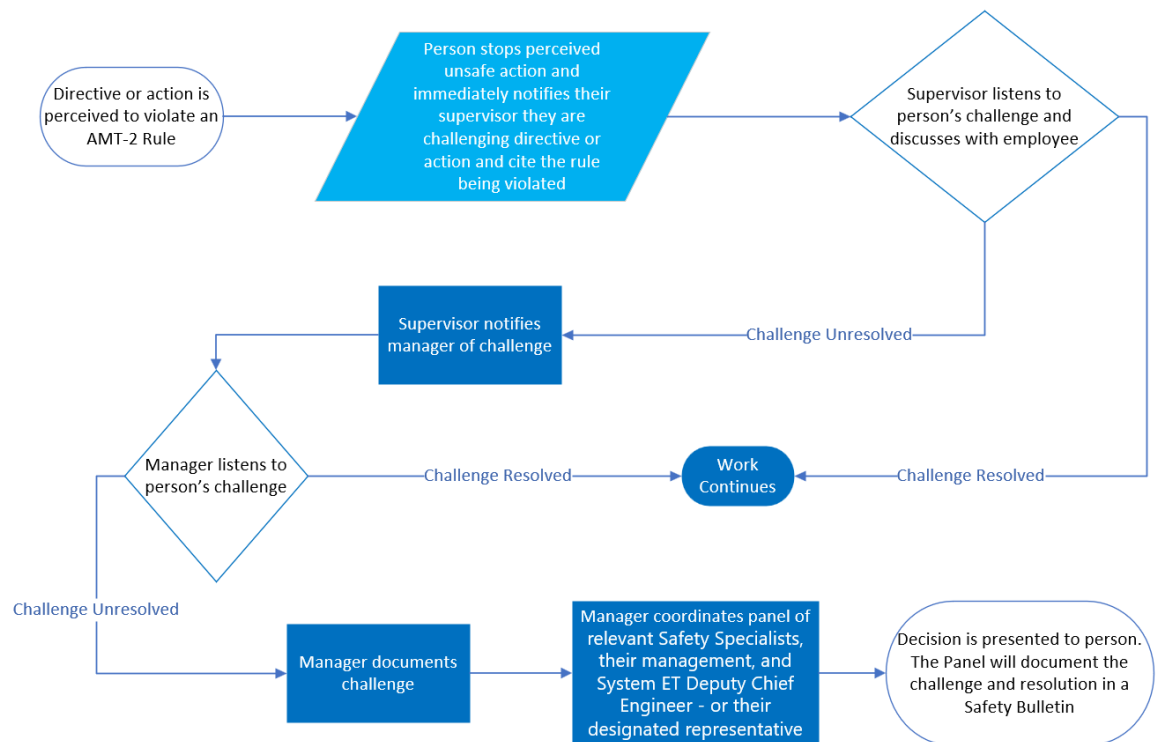
AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1. General Instructions for All Personnel

1.1 Safety

- 1.101 Safety is of the first importance in the discharge of duty. These rules provide for a safe and efficient operation. In case of doubt, the safe course must always be followed.
- 1.102 If in doubt as to the meaning or application of a rule, an employee must request an explanation from the proper authority. When any rule cannot be complied with, all work must STOP. The Deputy Chief Engineer of ET or their designated representative must be informed of the circumstances before proceeding with work.
- 1.103 Personnel conduct and any work instructions issued must comply with AMT-2 rules, policies, procedures, programs as well as posted instructions, placards, and verbal warnings.

Personnel are empowered to stop an unsafe operation and challenge in good faith any AMT-2 Rule not being complied with, using the process outlined below.



- 1.104 All personnel working in Electrified Territory must be familiar with and obey all rules and special instructions that relate to their duties.
- 1.105 Electrical circuits/apparatuses must always be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) and Minimum Approach Distances apply unless de-energized, tested de-energized and if applicable, appropriate temporary protective grounds / third rail warning devices applied.
- 1.106 When working on circuits energized at 600 volts or greater, two employees must be on the site.
- 1.107 Do not work on or about an electric circuit, apparatus, or component unless qualified and authorized.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 1.108 When a Class "D" Person is working under the direction of a Class "A" Employee without a clearance/work permit/Third Rail DC Power Permit, the Class "D" Person will be instructed by the Class "A" Employee to which distance they may approach a circuit/apparatus not to violate Class "C" Minimum Approach Distances and noted on the Job Briefing.
- 1.109 Steel tape measure or linen tapeline containing metallic reinforcement must not be within 15 feet of the electric traction system.
- 1.110 Any electrical equipment/apparatus found to be not operating as intended or available for service must be reported to the Power Director, tagged out of service, and tracked for repair.
- 1.111 Prior to placing a new or repaired electric traction system, component, wire, equipment, apparatus, etc. in service or back in service approval from the Deputy Chief Engineer of ET or their designated representative must be obtained per SOI-225 Electric Traction System Commissioning.
- 1.112 Before touching a structure carrying a live circuit, examine it to ensure that it is not energized due to broken insulator, slack wire, or other such condition. If in doubt, contact the Power Director.
- 1.113 Personnel must not enter substations, frequency converter stations, control houses & huts, or electrical enclosures unless qualified and authorized.
- 1.114 The Power Director must be advised of all personnel entering and leaving any substation or ET enclosure.
- 1.115 The Load Dispatcher must be advised of all personnel entering and leaving a frequency converter station.
- 1.116 Work must not be done on top of locomotives, multiple units, or equipment under Overhead Catenary System, except as permitted by these instructions, and then only by a Class "A" or "B" Employee or under the direction of a Class "A" Employee.
- 1.117 Amtrak's Employee Safety Rulebook and SOI-201 – Electric & Arc Flash Protection Program, contains Amtrak's electrical and arc-flash personal protective equipment requirements for personnel to work on the electric traction system. This includes but is not limited to the use, inspection, maintenance and storage of arc-rated clothing and personal protective equipment, insulated rubber gloves and insulated rubber blankets (third rail mats).
- 1.118 Only qualified and authorized persons may work on circuits energized between 150 and 480 volts, utilizing insulated rubber gloves with leather gauntlets per SOI-201 and insulated tools with minimum rating of 1,000 volts.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.2 Emergency Conditions

- 1.201 All occurrences or emergency conditions which are likely to affect electric operation or when necessary to de-energize the overhead wire or third rail to prevent personal injury or damage to property, must be reported immediately to the Power Director / Train Dispatcher. Amtrak Police / CNOC must be notified as soon as possible of any injury/illness in which 911 was called.
- 1.202 When an overhead wire or third rail failure occurs that may obstruct tracks, all tracks that may be affected must be protected immediately.
- 1.203 Employees in electrified territory will be familiar with the location and operation of radios and telephones.
- 1.204 When using railroad telephone lines or radios, the word "EMERGENCY" repeated three times indicates an emergency. All others using the phone line or radio channel must yield immediately.
- 1.205 When a broken wire or obstruction that may damage a pantograph is found in the catenary:
- A. A hand signal to drop pantograph must be given to approaching electric equipment by swinging arm in a circular motion at full arm's length, at a right angle to the track.



FIGURE 1 - DROP PANTOGRAPH HAND SIGNAL

- B. Engineer will drop pantograph(s) immediately and acknowledge hand signal by two short sounds of the horn.
- C. After all pantographs have passed the affected area, the engineer may raise pantograph(s).
- 1.206 Emergencies in Tunnels
- A. In the event of a fire or emergency situation on a train moving through a tunnel, every effort must be made to expedite movement of the train out of the tunnel.
- B. Train crews must promptly establish communication with the engineer to discuss appropriate action to keep the train moving.
- C. The train must not be stopped unless there is reason to believe that derailment or personal injury may otherwise result.
- D. Evacuating customers from a train in a tunnel should be a last resort in extreme emergencies. If evacuation becomes necessary, Power Director must remove power from catenary/third rail circuits in the immediate area. Personnel should evacuate to a walkway (if possible) on the opposite side, or a safe distance away from any potential power source.
- E. If train is inside a North River, East River, and Empire Tunnels at the time fire or smoke conditions are detected ET Employees must follow SOI-223.

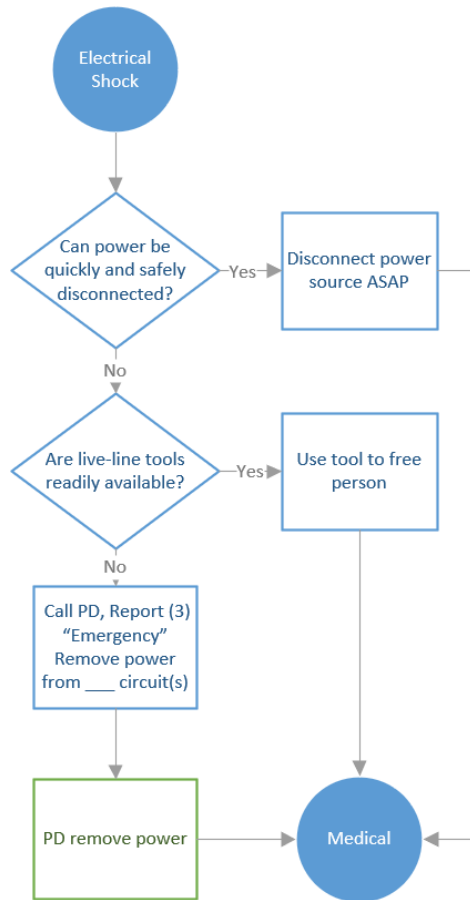
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 1.207 When using extinguishers, the operator must consider all circuits/apparatus ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) until they have been de-energized, tested de-energized, and grounded as necessary.
- A. The use of water on energized circuits/apparatus/equipment is prohibited.
 - B. Handheld fire extinguishers should never be used in such a way that the stream can strike any electrical apparatus until power has been removed and the wires grounded, if possible.
- 1.208 Special considerations for fires in proximity to overhead wires:
- A. Fires in proximity to overhead wires may interrupt power and must be reported immediately to the Power Director and Train Dispatcher.
 - B. During a fire, all persons must keep as far as possible from energized high voltage conductors which might fall.
 - C. Power Director must remove power from circuits/apparatuses when flames or loose portions of buildings may contact the electric traction system.
 - D. Firefighting apparatus, hose streams, or fire extinguishers that may contact the electric traction system must not be utilized until overhead wires/third rail are de-energized, tested de-energized, and properly grounded/warning devices applied by an ET Class "A" Employee via a Clearance/Third Rail DC Power Permit.
- 1.209 Special considerations for fire on electrical equipment:
- A. If fire or smoke conditions exist on a locomotive, Power Director and Train Dispatcher must be notified and power must be removed from the Third Rail and Overhead Catenary System unless in a tunnel. If equipped, Main Circuit Breakers (MCBs) must be opened, pantograph(s) lowered, and pantograph ground switch closed.
 - B. On electrical engines, engine rooms are equipped with fixed extinguisher system. Pantographs must be lowered, blowers allowed to stop, and compartments closed, if possible, before fixed systems are used.
 - C. Portable fire extinguishers are provided on all of these engines for small fires.
- 1.210 Special considerations for fire on electrical apparatuses:
- A. Transformers may cause burning oil to be thrown. Carbon dioxide or dry chemical fire extinguishers should be used for first application, followed by the use of sand or earth to prevent fire spreading on the floor or ground. After fire is extinguished treat as hazardous material.
 - B. Foam type fire extinguishers may be used only, if necessary, where it can be applied to burning surfaces and inside of tanks. When piping systems permit, return oil to drainage tank.
 - C. For air-cooled apparatus, including transformers and rotating machinery, stop all air-cooling appliances and close dampers, if possible, before applying extinguisher to burning parts.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.211

General instructions for releasing victim from contact with a live conductor:



- A. Extreme care must be exercised in releasing a victim from contact with a live conductor, so the rescuer avoids becoming a victim too. If possible, deenergize the circuit by safest and quickest available means. If the circuit cannot be deenergized immediately, the rescuer will use adequate protection for their own safety:
- 1) If conductor voltage is known to be 480 volts or less, a rescuer may make use of a piece of dry non-conducting material such as a piece of wood, rope, or rubber hose to push or pull the victim from the conductor.
 - 2) If conductor voltage is unknown or to be greater than 480 volts, a rescuer may make use of a live-line tool (i.e., fiberglass epoxy rod, rescue hook, pantograph pole, shotgun stick, etc.) to push or pull the victim from the conductor. When handling live-line tool, the rescuer must utilize high voltage rubber gloves with leather gauntlets and keep hands out of Minimum Approach Distance.
- B. If such means above are not available to the rescuer, deenergize the conductor and if possible, apply a temporary protective ground, before removing the victim and providing appropriate medical care.

CAUTION

Always maintain Minimum Approach Distance from a live conductor or ANY part of a victim while they are in contact with such conductor. Never stand in water or on damp or wet ground while attempting to free a victim.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.212 When trains, locomotives or railroad equipment are derailed or to be evacuated in an emergency, the equipment must be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) until overhead wires/third rail are de-energized, tested de-energized, and properly grounded/warning devices applied by an ET Class "A" Employee via a Clearance/Third Rail DC Power Permit. If a derailment occurs:

- A. The Operator must attempt to drop all pantographs, close grounding switches (if equipped) and open any Main Circuit Breakers (MCBs) immediately.
- B. Personnel must not exit the equipment in a manner which permits simultaneous contact with the equipment and earth.
- C. Warn others to remain clear.

WARNING

If evacuation of equipment is necessary before overhead wire or third rail is de-energized, tested de-energized, and grounded/warning devices applied, personnel must facilitate evacuation in a manner which prevents simultaneous contact with the equipment and earth.

1.213 Downed wires must be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) until de-energized, tested de-energized, and properly grounded by an ET Class "A" Employee via a Clearance. Emergency responders, and all other personnel who are in the immediate area, must be aware that a potential gradient exists along the ground from the point (train, equipment, ground) that is touching the energized electrical source. Every effort should be made to move away to a safe distance to where the ground potential is less than 50 volts, by hopping or shuffling away keeping feet together to avoid any touch or step potential.

1.214 When a Roadway Maintenance Machine or Construction Equipment becomes in contact with an energized circuit (third rail, overhead or underground wire), it must be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) until wires/third rail are de-energized, tested de-energized, and properly grounded/warning devices applied by an ET Class "A" Employee via a Clearance/Third Rail DC Power Permit, unless it is unsafe to remain on equipment. If a contact with energized circuits occurs:

- A. If possible, break contact by moving the equipment clear of the wires. This may not be feasible where contact has welded conductors to equipment.
- B. Do not attempt to exit the equipment, unless other hazards are present (e.g., a fire). If necessary to evacuate, jump clear of equipment and hop or shuffle with feet together away from equipment to avoid any touch or step potential.
- C. Warn others to remain clear.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.3 Required Books and Publications

- 1.301 All personnel assigned duties within Amtrak's Electric Traction System must maintain and have readily available an Amtrak MDCS Device or a paper copy of AMT-2 Electrical Operating Rules and Instructions and applicable paperwork to job duties.
- 1.302 Personnel whose duties are affected by General Orders, Bulletin Orders, or Division Notices must be familiar with and comply with instructions pertaining to the portions of the territory on which they are qualified or ordered to operate.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.4 Training

- 1.401 All personnel working in Electrified Territory must attend required training and pass an AMT-2 Electrical Operating Rules and Instructions examination per qualification classification before they perform service in electrified territory.
- 1.402 Personnel who attend and complete contractor training course will be considered Class "D".
- 1.403 SOI-210 contains initial and annual qualifications, demonstration, certification, and requalification requirements for all Class "A" Employees.
- 1.404 Amtrak AMT-2 qualified and authorized employees Class "A", "B", or "C" who work on or about an electric circuit, apparatus, or equipment must be trained in, and familiar with:
- A. The safety-related work practices, safety procedures, and other safety requirements that pertain to their job assignments, including applicable emergency procedures (such as pole-top and manhole rescue), that are not specifically addressed in these rules but that are related to their work and are necessary for their safety,
 - B. The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment,
 - C. The skills and techniques necessary to determine the nominal voltage of exposed live parts,
 - D. Minimum Approach Distances corresponding to the nominal voltages and frequencies to which the qualified employee will be exposed and the skills and techniques necessary to maintain those distances,
 - E. The proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools, and
 - F. The recognition of electrical hazards to which personnel may be exposed and the skills and techniques necessary to control or avoid these hazards.
- 1.405 Amtrak/contractor Class "A", "B" and IMCS/CapD Class "C" Personnel must attend and pass AMT-2 training annually. All other Class "C" personnel must attend and pass AMT-2 training every two years. Employees who fail this training or allow their qualifications to lapse must not perform duties in Electrified Territory. Employees qualifying in any month will carry qualifications to the last month of the following calendar year.
- 1.406 All personnel working on exposed circuits energized at 50 volts or greater must be trained in First Aid and Cardiopulmonary Resuscitation (CPR), unless working in a facility with designated First Aid and CPR trained personnel readily available. Class "A" Employees must be trained annually. All other Employees must be trained every two years.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.5 Job Briefings

- 1.501 Job Briefings must be conducted at the start of each job, when conditions change, or when new tasks are started.
- 1.502 Job briefings related to the Electric Traction System must cover, but are not limited to:
- A. Bulletin orders affecting these rules and instructions.
 - B. Known site specific electrical safety hazards, including but not limited to the location of nearby energized circuits.
 - C. Special instructions, Standard Operating Instructions, Job Safety Analysis, Engineering Practices, etc. governing unusual tasks to be performed.
 - D. Recent Alerts, Orders, Memos and Letters affecting Electric Traction System.
 - E. Work location, Limits of Protection / Work Area.
 - F. The number, type, and/or exact location of any of the following:
 - 1) Temporary protective grounding devices,
 - 2) Raised pantographs,
 - 3) Jumpers,AND/OR
 - 4) Third rail warning devices.
 - G. Work assignments for and means of communication of all personnel involved.
- 1.503 Job briefings must not be considered complete until all involved personnel have acknowledged their understanding of the information covered.
- 1.504 For personnel working under the direction of Class "A" Employee via a Clearance, Work Permit, and/or Third Rail DC Power Permit AND are breaching, operating or using tools/equipment within Minimum Approach Distances must be briefed, print first and last name, and sign onto/off respective form(s) indicating corresponding Protection. Personnel must print first and last name, and sign-off afforded protection anytime leaving job site and be briefed, print first and last name, and sign-on again upon return.
- 1.505 Personnel joining a work group are responsible for seeking out the Person in Charge to be briefed before performing work.
- 1.506 Before any work to be completed by IMCS and Capital Delivery Personnel when there are fall hazards present, an Engineering (NRPC 4104) and Engineering Fall Protection (NRPC 3418) Job Briefings must be received and acknowledged by all personnel involved in work.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.6 Communication

- 1.601 The following work-related matters, conducted with Power Directors/Load Dispatchers, must be conducted on a recorded line using three-part communication:
- A. Any information, instruction or advice that could affect the safety of railroad operations, electric traction system, or personnel.
 - B. Operation or modification of electric traction equipment.
 - C. Reporting the status or condition of electric traction equipment or the value of an important parameter.
 - D. In the performance of steps or actions related to a Standard Operating Instruction or Engineering Practice.
- 1.602 Radio/phone communications must be conducted per governing operating rule(s) and/or Employee Safety Rules.
- 1.603 Emergency communications to the Power Director via phone should be done utilizing the Emergency Phone numbers.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.7 Minimum Approach Distances

- 1.701 Personnel must always maintain Minimum Approach Distance to ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) circuits/apparatus, accounting for all tools, equipment or material being used with reasonably likely movements for work to be performed unless Protection is provided, or exceptions noted in these instructions. See AC and DC Minimum Approach Distance Tables.

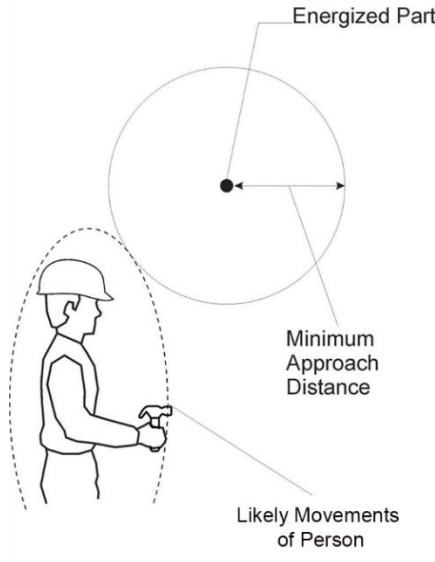


FIGURE 2 - MAINTAINING MINIMUM APPROACH DISTANCE

- 1.702 Personnel must not place themselves on any train or equipment that would put them within Minimum Approach Distance of energized circuits/apparatus.
- 1.703 Non-Amtrak personnel, qualified in the electrical trade, working near Amtrak's Electric Traction System will not work closer than 15 feet to overhead wires or apparatus or 4 feet to third rail unless protected by a Class "A" Employee or working under an approved work plan by the Deputy Chief Engineer – ET or their designated representative.
- 1.704 Keep at least 15 feet away from downed/dangling wire or any foreign objects that may be hanging from or may be in contact with power transmission, catenary system, signal system, electric wire, or third rail. These objects are to be considered as ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE). Report condition to Power Director by quickest available means of communication. Take necessary precautions to protect others and equipment. ET Class "A" employees may breach 15 feet but not closer than AC/DC Minimum Approach Distances.
- 1.705 Minimum Approach Distance must be maintained from wires, electrical apparatus, or equipment with insulation, weather proofing, or coverings. They cannot be depended upon for protection against electrical shock.
- 1.706 Minimum Approach Distance does not apply to electrical equipment equipped with appropriate manufacturer cabinet doors that are closed, bonded to ground and approved by the Deputy Chief Engineer of ET or their designated representative. These doors may be used as a barrier to ensure personnel are not exposed to ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) equipment.
- 1.707 Minimum Approach Distances do not apply to circuits/apparatuses in an Electrical Isolated Construction Zone as detailed in SOI-228, that have temporary protective grounds and are physically disconnected from all ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) circuits/apparatuses.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.8 Electrical Equipment

- 1.801 If any third rail shoes are in contact with the third rail, all shoes must be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE), unless the third rail is de-energized, tested de-energized, third rail warning device applied by a Class "A" Third Rail Employee via a Third Rail DC Power Permit.
- 1.802 Electric equipment under overhead wires must be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE), except when it is known that ALL pantographs are down and pantograph grounding switches are closed, or overhead wires are de-energized, tested de-energized, and equipped with temporary protective grounds by an ET Class "A" Employee via a Clearance OR within a mechanical facility when the Class "B" Person performs a Site-Specific Catenary Isolation Procedure.
- A. Where two pantographs are located on one unit, they are electrically connected. The pantograph in the UP position energizes the pantograph that is in the DOWN position. When either of the pantographs is in the UP position, both pantographs must be considered ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) until such time as the jumpers are physically removed from between the pantographs/cars.
 - B. Married pair cars have a high voltage bus jumper connecting the pantograph on one unit to the transformer on the second unit.
 - C. HST Type 1 power units are considered separate units.
 - D. NexGen HST power units are electrically connected.
- 1.803 Only Class "A" or "B" Personnel or others under the supervision of the Class "A" Employee may go on the top of electric equipment following SOI-229 – Procedures to Access Top of AC Electrical Equipment.
- 1.804 Pantograph poles (a type of live-line tool) must be carried on all AC propelled equipment. Only an ET Class "A" Employee donning rubber gloves and leather gauntlets may use an in-date pantograph pole to raise or lower pantographs.
- 1.805 Pantograph poles stored on Amtrak AC propelled equipment must be removed from service every 2 years for inspection, evaluation, and dielectric testing.
- 1.806 When practical, personnel should observe the condition/operation of pantograph(s) of passing trains. The Power Director and Train Dispatcher must be notified of any train with a defective pantograph(s).
- 1.807 When there are visible defects or obstructions in the catenary that may damage pantographs, pantographs must be dropped, and catenary conditions and the location of the defect(s) must be reported to the Power Director and Train Dispatcher.
- 1.808 When pantographs are damaged, electric equipment must be stopped immediately, notify the Train Dispatcher, and await instructions. Electric equipment must not be moved until all broken pantographs have been removed, secured, and/or properly isolated.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.9 Roadway Maintenance Machines and Construction Equipment

- 1.901 Roadway Maintenance Machines must not operate into energized catenary from de-energized track with a raised pantograph.
- 1.902 Roadway Maintenance Machines, being protected by a clearance, must not pass through a section break within the limits of a Clearance until the opposite circuit has been tested de-energized per SOI-203.
- 1.903 Roadway Maintenance Machines operators must not allow equipment to come within Minimum Approach Distance to any circuit/apparatus that is not properly protected.
- 1.904 The operator is responsible for the raising, lowering and locking of pantograph.
- 1.905 The Class "A" Employee holding the Clearance is responsible for directing the Roadway Maintenance Machine operator to raise and lower pantograph and ensuring the pantograph is in proper position after being operated.
- 1.906 The Class "A" Employee holding the Clearance must direct the raising of the grounded pantograph against trolley wire, when practical, before allowing personnel on top of the equipment.
- 1.907 The Class "A" Employee holding the Clearance must ensure the grounded pantograph is lowered and locked prior to Roadway Maintenance Machine operating out of Limits of Clearance or releasing the Clearance.
- 1.908 EP 7012 provides uniform guidance for using the Electric Traction Catenary Geometry Measurement Car (10005) to inspect electric traction catenary geometry as well as a timely and effective remedial action to any exceptions identified as critical.
- 1.909 EP 7011 provides a uniform procedure for requesting consideration for Class "C" Personnel Minimum Approach Distances for contractor owned and operated LORAM Railvac (LRV) equipment in Tracks Equipped for AC Electrical Operation.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.10 Bonding and Grounding

- 1.1001 Any equipment used within 25 feet of the Electric Traction System must be bonded and grounded in accordance with ET Specification No. 16064 / SOI-213 for the purpose of preventing static buildup and tripping of circuits in case of contact with energized conductors. It is the responsibility of the operator to inspect and verify that their equipment is properly grounded before each use.
- 1.1002 When grounding the Electric Traction System, temporary protective grounds must be used, designed, inspected, maintained, and stored according to SOI-212.
- 1.1003 Any metallic fencing or other electrically conductive infrastructure within electrified railroad right-of-way must be bonded and grounded to prevent touch potential hazards per Amtrak standards and specifications.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.11 Impedance Bonds and Rail Return System

- 1.1101 Running rails and impedance bonds must not be stepped or walked upon.
- 1.1102 Loose or broken rail return and impedance bond connections must be regarded as ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE), having the potential of the Overhead Catenary System Voltage. Minimum Approach Distance must be maintained until jumpers have been applied.
- 1.1103 Before disconnecting leads of impedance bonds or removing section of rail, on tracks equipped for AC and/or DC electrical operation, jumpers must be applied to ensure a return path for traction current is maintained.
- 1.1104 Before disturbing any connection with an unknown neutral connection or a drain lead directly to a substation or heater station, an ET Class "A" Employee must obtain a Work Permit per SOI-209.
- 1.1105 Open ground return circuits between track and substation bus or apparatus grounds only after being sure that connected apparatus is de-energized.
- 1.1106 Before working on any substation rail return bus, obtain a Work Permit per SOI-209 and properly apply grounds to the bus.
- 1.1107 Connections for electric traction return current shall not be made from one rail of a track to either rail of an adjacent track except between propulsion return rails where single rail track circuits are used.
- 1.1108 When one side of an impedance bond is disconnected from rail, the insulated joint involved must have jumpers applied to provide for a return path. When neutral leads of impedance bonds are removed, both insulated joints must have jumpers applied to provide for a return path.
- 1.1109 In cab signal territory, a jumper must first be applied across the track from rail to rail to ensure no cab signal energy or track circuit energy is improperly passed through the location. This jumper must be applied before the insulated joint or joints are bonded around.
- 1.1110 In all cases, jumpers must be of sufficient capacity to maintain an adequate return path in the territory involved, and they must be removed as soon as they are no longer needed.
- 1.1111 Jumpers must not be applied until proper track protection has been provided.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 1.1112 Method of applying temporary rail jumpers in electrified territory when impedance bond side leads are to be removed or when neutral of bonds are to be opened.

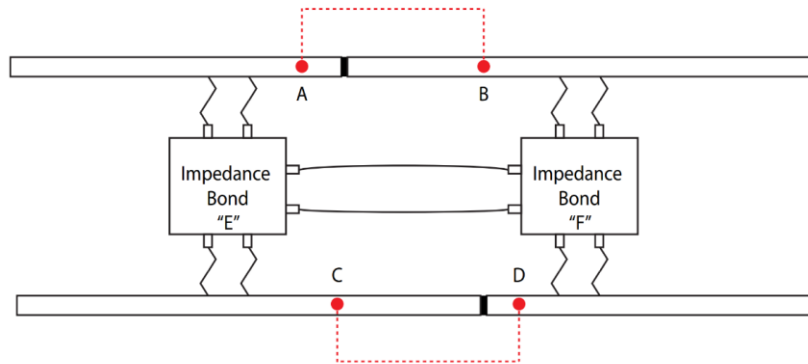


FIGURE 3 - APPLYING JUMPERS FOR REMOVING IMPEDANCE BOND SIDE LEADS

NOTE

Make jumper connections A - B and C - D before disconnecting side leads of impedance bond E or F, rails, or opening a neutral bond, allow the jumper connections to remain in place until impedance bonds are properly connected to rails.

- 1.1113 Method of applying temporary rail jumpers in electrified territory when rail, to which impedance bond is connected, is to be removed from track.

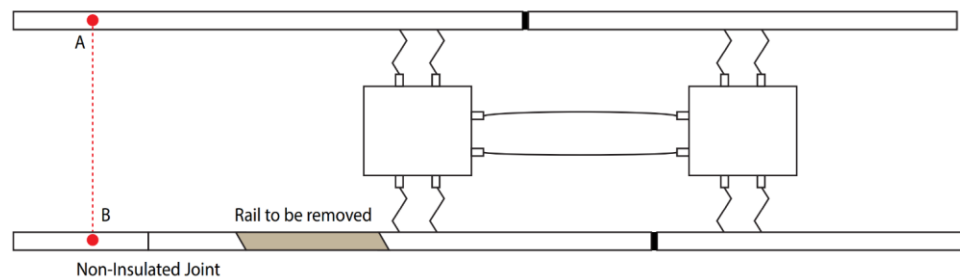


FIGURE 4 - APPLYING JUMPERS FOR REMOVING RAIL WITH IMPEDANCE BOND

NOTE

Make jumper connections A - B before impedance bond connection to rail is removed. Allow connection A - B to remain in place until the new rail is installed, and impedance bond connected to it.

- 1.1114 Method of applying temporary rail jumpers in electrified territory when rail is cut or a section of rail is to be removed from track.

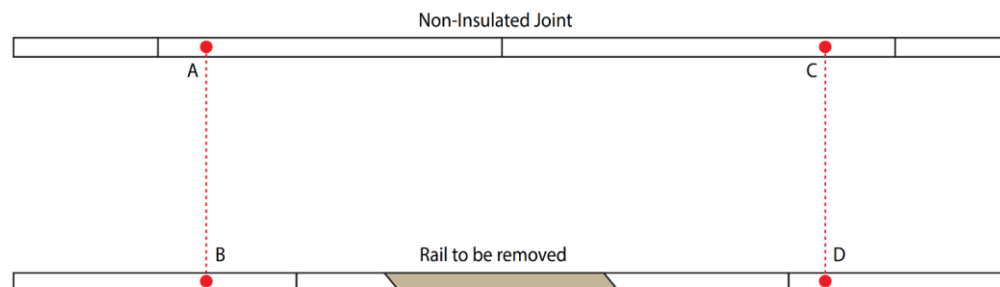


FIGURE 5 - APPLYING JUMPERS FOR REMOVING RAIL WITH NO IMPEDANCE BOND

NOTE

Make jumper connections A - B and C - D before rail or rail bonds are to be removed. When new rail is in place and joint bars tightened, remove jumpers A - B and C - D.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 1.1115 When more than 100 feet of adjoining rails are to be removed, a bonding plan must be approved by the Deputy Chief Engineer of ET or their designated representative before rail is to be cut. General method of applying temporary rail jumpers in electrified territory for when both rails are to be removed.

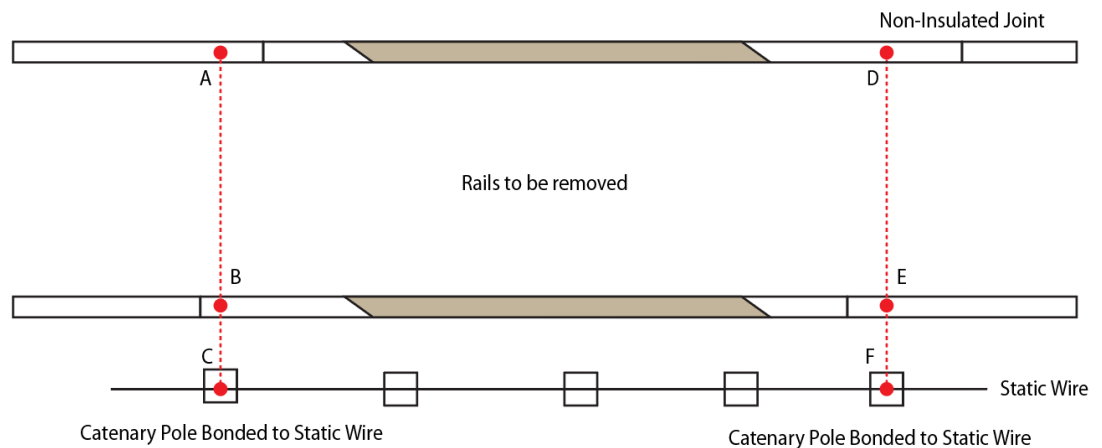


FIGURE 6 - APPLYING JUMPERS FOR REMOVING BOTH RAILS WITH NO IMPEDANCE BOND

NOTE

Make jumper connections C - B - A and F - E - D before rail or rail bonds are to be removed. When new rail is in place and joint bars tightened, remove jumpers A - B - C and D - F - E. Static Wire between points C and F must be continuous. Rail connections must be within 2 miles of rail to be removed.

- 1.1116 EP 5100 ensures an adequate traction return current path for peak loads and for fault protection, while permitting the track circuits in the signal system to provide broken rail protection.
- 1.1117 Standard Plan SP814 illustrates typical "A", "B", & "C" Points and Drain Bond Locations.
- 1.1118 AMT-23 Rule 154 outlines requirements for ensuring return path for traction current is maintained before disconnecting leads of impedance bonds or removing rails, frogs, etc.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.12 Third Rail

- 1.1201 Personnel must not walk between energized third rail and near running rail.
- 1.1202 Personnel must not ascend or descend bench walls on energized third rail side.
- 1.1203 Personnel must not work between energized third rail and near running rail unless insulated rubber blankets have been installed by a qualified ET Class "A" Third Rail Employee.
- 1.1204 Personnel must not dig, pass tools or equipment under energized third rail unless insulated rubber blankets have been installed by a qualified ET Class "A" Third Rail Employee.
- 1.1205 Personnel must not step, walk, sit, allow tools, clothing, or any part of the body to be brought in contact with the protection board.
- 1.1206 Conductive tools or equipment may not be used for work within 4 feet of energized third rail.
- 1.1207 The third rail must not be utilized for securing any type of equipment with chains, straps, or any other type of securing device.
- 1.1208 EP 7060 establishes a uniform procedure for using, inspecting, and storing third rail warning devices for ET Class "A" Third Rail Employees.
- 1.1209 Only ET Class "A" Third Rail Employees may work on energized third rail, operate manual third rail switches or install/remove third rail jumpers with permission of a supervisor, utilizing appropriate insulated rubber gloves with leather gauntlets per SOI-201 and insulated tools with minimum rating of 1,000 V.

NOTE

Third rail maintenance and construction activities such as hucking and soldering applications must not be performed under energized conditions.

- 1.1210 Only ET Class "A" Third Rail Employees may install approved and tested insulated rubber blankets per SOI-201 on energized third rail to shield Class "A", "B" and/or "C" personnel. Class "D" Personnel cannot work under this level of Protection.
- 1.1211 Only tools equipped with wooden or insulated handles may be used while utilizing insulated rubber mats as a form of protection, provided person's hands do not come within 3 inches of any conductive portion of the tool.
- 1.1212 While working under rubber mat protection, tools, equipment, or material must not come within 18 inches of exposed energized third rail.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.13 Batteries

- 1.1301 Class "A" Employees must follow SOI-226 Control House and RTU Batteries when inspecting, performing maintenance and/or installing batteries in relation the to the Electric Traction System.
- 1.1302 Only qualified and authorized personnel may work on control house battery systems or DC Control Circuits live. When disconnecting, connecting, or testing batteries insulated rubber gloves with leather gauntlets per SOI-201 and insulated tools with minimum rating of 1,000 V must be used.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.14 Generators/Inverters

- 1.1401 Any generator or inverter interconnected to the Electric Traction System that are operated or maintained by Amtrak must be reviewed and approved by the Deputy Chief Engineer – ET or their designated representative. Generators that are isolated from the Electric Traction System and used to power tools or lighting do not require approval.
- 1.1402 Generators/inverters must always be located in a well-ventilated area, at minimum 5 feet from any building.
- 1.1403 Permanent generator or inverter installations must include a blocking device to prevent back feeding.
- 1.1404 When a Clearance is being taken on equipment or apparatus that can be back fed from a generator or inverter, blocking points must be established to prevent unintended back-feed.
- 1.1405 Prior to any generator or inverter being connected to an Electric Traction System the Power Director must be notified.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.15 Switch Heaters

- 1.1501 IMCS, in anticipation to inclement weather, i.e., snow, sleet, or freezing rain, will authorize track switch heaters to be on/off and notify Power Directors.
- 1.1502 Power Directors will document track switch heaters being turned on/off via ET Logbook entry.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.16 Use of Approved Barriers

- 1.1601 Design of a proposed barrier must be submitted to and approved in writing by the Deputy Chief Engineers – ET and Structures or their designated representatives.
- 1.1602 Barrier design must consider clearance envelope for the movement of trains, where applicable.
- 1.1603 Barriers must be constructed to maintain electrical clearances to energized parts, as listed below. Wire deflection due to weather or pantograph movement must be considered when calculating these distances and added to the minimum clearances shown here:

TABLE 1 - APPROVED BARRIER MINIMUM CLEARANCE

Voltage (V)	Minimum Clearance (inches)	
	Horizontal	Vertical
750 DC	12	6
1,000 – 35,000 AC	18	9*
35,000 – 138,000 AC	72	72

*Barriers of timber construction require 12". Clearance to grounded steel is 9".

- 1.1604 Barriers constructed from metallic materials must be securely grounded.
- 1.1605 Barriers constructed from non-metallic materials must have a ground wire secured to the top of the barrier.
- 1.1606 Barriers must be secured and un-movable from the time it is placed in service until the time the barrier is no longer needed and removed.
- 1.1607 Barriers used as walking/working surfaces for vertical clearances above energized parts must be constructed in such a way that no access to areas below exists.
- A. Any gaps along edges or in seams must be filled with foam or other expanding agent to completely seal protected area.
 - B. Barriers must be designed and constructed not to allow water or other conductive fluids from leaking onto energized parts. Water or other fluids must be channeled away from the energized areas and allowed to drain safely.
 - C. Barriers must be designed and constructed to prevent debris from falling through and contacting energized parts or equipment.
- 1.1608 Barriers used for horizontal clearances must be constructed solidly. If necessary to allow wind to pass through, small weep holes must be arranged so that extraneous items such as hoses, wire, cable, and tools cannot protrude through the protected area.
- A. Barriers must be constructed so that the work area is not accessible to the general public or passengers.
 - B. Barriers must be a minimum of 6 feet 6 inches above the work area or capped or constructed in such a method so that items cannot be thrown over or around the barrier into the energized area or into the train envelope.
 - C. All barriers must contain Danger High Voltage signs at all entrances and every 20 feet, to warn workers of the danger on the other side.
 - D. Barriers are prohibited from protecting heavy equipment such as bobcats, mini-excavators, backhoe, etc. unless specifically designed to do so.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- E. Barriers must be constructed/removed under the direction of a Class "A" Employee to ensure a safe work area during construction.
- 1.1609 Prior to use, barriers must be inspected and approved by the Assistant Division Engineer – ET or their representative to ensure they meet the approved design criteria and are sufficient to provide protection.
- 1.1610 Approved barriers must have an NEC 101 Green Tag affixed, in appropriate weather proofing container, in visible location to indicate an inspection process has been completed. The Assistant Division Engineer – ET or their representative will notify ET System Office when a barrier inspection occurs and gets approved. A list of active approved barriers will be kept on the ET SharePoint.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.17 Electrical Switching and Tagging

- 1.1701 Manually operated disconnect switches, when not being operated, must be locked with an ET approved locking device.
- 1.1702 Under no circumstances will any electrical switch tied into the electric traction system be operated or confirmation of switch position be performed by any field employee, except:
- A. As permitted by AMT-2 Rule, Standard Operating Instruction, Engineering Practice, or Site-Specific Catenary Isolation Procedure.
 - B. Class "A" Employees authorized by Power Director and Load Dispatcher per SOI-224 Electrical Switching and Tagging.
- OR
- C. Class "A" Employees operating switches within the limits of a Clearance, Work Permit, and/or Third Rail DC Power Permit.
- 1.1703 When hand-operated switches must be closed for ground continuity after a Clearance has been issued, they must be checked closed, locked closed, a Do Not Operate Tag - Red Tag (NEC 105) applied and reported to the Power Director.
- 1.1704 When motor operated disconnects must be closed for ground continuity after a Clearance has been issued, they must be checked closed, locked closed, control power removed or disabled, a Do Not Operate Tag - Red Tag (NEC 105) applied, and reported to the Power Director.
- 1.1705 Do Not Operate Tag - Red Tag (NEC 105) utilized for blocking devices will not be removed except as instructed by the Power Director.
- 1.1706 Before removing or directing the removal of Do Not Operate Tags (NEC-105), The Class "A" Employee must ensure that all personnel, equipment, tools, grounds, pantographs, warning devices, etc. are in the clear of the circuits/apparatus involved.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.18 Use of Live-Line Tools

- 1.1801 All Live-line tools used in application to Amtrak's Electric Traction System must be used, designed, inspected, maintained, and stored according to SOI-207 and only by Qualified Class "A" or "B" personnel, or trainees working under their direction.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.19 Use of Electrical, Voltage Sensing and Verification Devices

- 1.1901 All electrical, voltage sensing and verification devices utilized to test Amtrak's Electric Traction System de-energized must be used, designed, calibrated, inspected, maintained and stored in accordance with appropriate Standard Operating Instruction, Engineering Practice and/or manufacture guidelines.
- 1.1902 SOI-203 Voltage Testing and Verification Procedure details the procedures used when necessary for Class "A" or "B" personnel to test the Transmission, Overhead Catenary, Signal Power, Third Rail System de-energized in connection with receiving an Electrical Clearance, Third Rail DC Power Permit or completing a Catenary Isolation Procedure.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.20 Catenary Isolation Procedure

- 1.2001 Only Class "B" Personnel can place themselves on electric equipment or controlled elevated platforms within Mechanical Facilities equipped with Catenary Isolation Devices in which doing so would place the person in Minimum Approach Distance and then only after Protection is established by a Qualified Class "B" Person utilizing a Site-Specific Catenary Isolation Procedure, in which Overhead Catenary System is de-energized, tested de-energized, and properly equipped with Temporary Protective Grounds.
- 1.2002 Only Class "B" Personnel can work under the Protection of another Class "B" Person.
- 1.2003 Class "A" Employees cannot use catenary isolation systems as Protection for themselves or other personnel.
- 1.2004 All Mechanical Facilities equipped with Catenary Isolation Devices must have a documented site-specific procedure for safe operation. Procedures must be approved by the Deputy Chief Engineer – ET or their designated representative and a copy readily available on site. A list of approved Site-Specific Catenary Isolation Procedures will be kept on the ET SharePoint.
- 1.2005 Only qualified and authorized Class "B" Personnel may carry out Site-Specific Catenary Isolation Procedures.
- 1.2006 All Class "B" Personnel must be familiar with the Site-Specific Catenary Isolation Procedures governing their work location.
- 1.2007 Personnel are prohibited from making any modifications to the Catenary Isolation Devices and/or components to the Electric Traction System unless approved by the Deputy Chief Engineer – ET or their designated representative.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.21 Electrical Clearance Procedure

- 1.2101 For any personnel to work within Minimum Approach Distances to AC Electric Traction circuits/apparatuses normally energized above 480 volts must be Protected by a Qualified Class "A" Employee in which the circuit/apparatus is de-energized, tested de-energized, and properly equipped with Temporary Protective Grounds via a Clearance.

NOTE

Exception when Temporary Protective Grounds cannot be applied under special circumstances as noted by a Standard Operating Instruction, Engineering Practice, or these instructions the circuit/apparatus may be Protected under a Work Permit.

- 1.2102 All Class "A" Employees are governed under SOI-211 when necessary to obtain and manage a Clearance.
- 1.2103 AMT-23 Rule 54 lists requirements for isolation of signal power feeds from signal power lines maintained by Electric Traction or AMT-2 Class "A" qualified personnel when required for protection to ensure energy is not inadvertently applied to circuits while personnel are working on equipment and impacted signal infrastructure is documented and restored to normal operating condition after isolation is no longer required.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.22 Work Permit Procedure

- 1.2201 For any personnel to work within Minimum Approach Distances to Electric Traction circuits/apparatuses normally energized 480 volts or below under the purview of the Power Director must be Protected by a Qualified Class "A" Employee via a Work Permit.

NOTE

When Temporary Protective Grounds cannot be applied to a circuit/apparatus normally energized above 480 volts under special circumstances as noted by a Standard Operating Instruction, Engineering Practice, or these instructions the circuit/apparatus may be Protected under a Work Permit.

- 1.2202 All Class "A" Employees are governed under SOI-209 when necessary to obtain and manage a Work Permit.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

1.23 Third Rail DC Power Permit Procedure

- 1.2301 For any personnel to work within Minimum Approach Distances to Third Rail circuits/apparatuses without Insulated Rubber Blankets, Insulated Rubber Gloves and Leather Gauntlets, or Live-line Tools, the circuits/apparatuses must be Protected by a qualified ET Class "A" Third Rail Employee in which third rail is de-energized, tested de-energized, and properly equipped with Third Rail Warning Devices via a Third Rail DC Power Permit.
- 1.2302 Class "A" Employees are governed under SOI-220 when necessary to obtain and manage a Third Rail DC Power Permit.
- 1.2303 Class "A" Employees are governed under SOI-215 when Roadway Workers require protection in proximity to third rail owned by the Long Island Railroad (LIRR).

2. Rules and Instructions Pertaining Transportation Activities

2.1 Train Movement

- 2.101 The Train Dispatcher, Yardmaster, or the Employee in charge of track(s) must not authorize electric equipment for movement or grant permission to raise pantographs / equip third rail shoes on tracks not equipped for respective AC/DC electric operation.
- 2.102 When transferring employees or passengers to an adjacent train, the following rules apply:
- A. Traction power must not be applied on either train until the process is complete.
 - B. When operating on Tracks Equipped for DC Electrical Operation, the third rail must be properly de-energized prior to transfer.
 - C. Due to a difference in electric potential between equipment, one of the following must be adhered to when transferring passengers to an adjacent train (listed in order of preference):
 - 1) If jumpers are available and capable of reaching, spot one train adjacent to another and attach jumpers between adjacent equipment, prior to transfer. This must be done with or without a bridge plate.

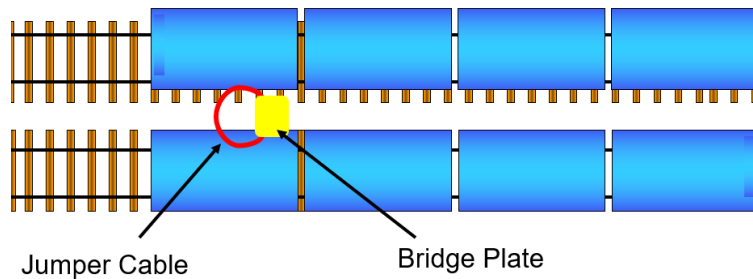


FIGURE 7 - APPLYING JUMPERS FOR PASSENGER TRANSFER BETWEEN EQUIPMENT

- 2) If jumpers are not available or capable of reaching, stagger the adjacent train on an adjacent track, do not use bridge plates, and position trains so that doors do not line up, to avoid simultaneous contact between equipment.

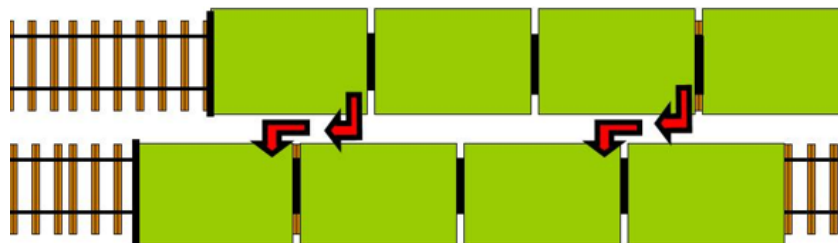


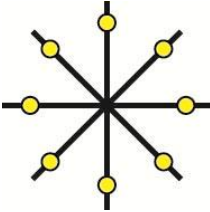
FIGURE 8 - TRANSFERRING PASSENGERS BETWEEN EQUIPMENT WITH NO JUMPERS

- 3) If jumpers are not available and a bridge plate must be used, pantographs on both trains must be lowered prior to transfer.
- D. Amtrak Train Crews must follow procedures outlined in Service Standards Manual for Train Service and On-Board Service Employees.
- 2.103 The Power Director shall notify the Train Dispatcher immediately when a Position Light Phase Break Indicator is lit. The Train Dispatcher will notify affected trains verbally or by Form D.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.2 Signal Aspects and Indications

TABLE 2 - SIGNAL ASPECTS AND INDICATIONS

Rule	Name	Aspect	Indication
2.201	Approach Dead Section Sign	 FIGURE 9 - APPROACH DEAD SECTION SIGN	Indicates that a Dead Section is 15 seconds in advance. Electric Equipment, place Throttle/Controller in OFF and open the Main Circuit Breaker (MCB), if equipped, keeping it in that position until the Dead Section is passed.
2.202	Dead Section Sign	 FIGURE 10 - DEAD SECTION SIGN	Indicates that a Dead Section is 2 catenary poles in advance. Electric Equipment, place Throttle/Controller in OFF and open the Main Circuit Breaker (MCB), if equipped, keeping it in that position until the Dead Section is passed.
2.203	Dead Section Stop Sign	 FIGURE 11 - DEAD SECTION STOP SIGN	When Electric equipment has Restricting cab signal or inoperative cab signals, indicates Stop. The Dispatcher may grant permission to pass the sign only after: - The corresponding home signal is displayed, or - The train is authorized under Rule 241 to pass the home signal at Stop.
2.204	Position Light Phase Break Indicator	 FIGURE 12 - POSITION LIGHT PHASE BREAK INDICATOR	When lit, indicates a section of the Phase Break is de-energized. Electric equipment will be governed by the following: - Electric equipment equipped with a Main Circuit Breaker (MCB), will place the throttle/controller in the OFF position and open the Main Circuit Breaker (MCB), keeping it in that position until the Phase Break is passed. - Multiple Electric Locomotives coupled with both pantographs up on leading unit and rear pantograph up on each trailing unit except through Phase Break (when lit). Drop all pantographs prior to entering the Phase Break. - One unit of electric equipment, not equipped with a Main Circuit Breaker (MCB), with one pantograph up will place throttle/controller in OFF position before entering the Phase Break, keeping it in that position until the Phase Break is passed. - Electric equipment with both pantographs up, or multiple electric equipment, not equipped with a Main Circuit Breaker (MCB), must place controller in OFF position and drop pantograph(s) before entering Phase Break. Keep pantographs in this position, until Phase Break is passed. Speed must be reduced to 60 MPH before raising pantograph(s). Located in advance of the Position Light Phase Break Indicator Sign.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.205	Position Light Phase Break Indicator Sign	 FIGURE 13 - POSITION LIGHT PHASE BREAK INDICATOR SIGN	Indicates the start of the Phase Break. These signs are located on the first catenary pole in advance of a Phase Break.
2.206	AC Motor Stop Sign	 FIGURE 14 – CATENARY AC MOTOR STOP SIGN	Placed in the catenary or to the right of the rail to indicate the end of contact wire. Electric engines and MU equipment must not pass the sign with their pantograph(s) up.
2.207	Switch AC Motor Stop Sign	 FIGURE 15 - SWITCH AC MOTOR STOP SIGN	Placed on hand operated track switch throw mechanism. Indicates no contact wire for certain movements. Electric engines and MU equipment must not pass the sign with their pantograph(s) up when switch is aligned for movement to track with no contact wire.
2.208	Raising Pantograph Sign	 FIGURE 16 - RAISING PANTOGRAPH SIGN	In Mechanical Facilities used in conjunction with the AC Motor Stop placed at a height that can be seen clearly from cab of a Power Car. Indicate the point at which it is permissible to raise pantographs. For HST, lowered pantographs are not to be raised until the cab side window on the appropriate end is adjacent to these signs.
2.209	Ground Flag	 FIGURE 17 - GROUND FLAG	Indicate the point at which Temporary Protective Grounds fouling a track are placed.
2.210	Section Break Sign	 FIGURE 18 - SECTION BREAK SIGN	Indicates the location of section breaks.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.3 Pantograph Operations

- 2.301 Under normal operation of single or coupled electric locomotives the trailing pantograph must be up on each unit. When a trailing pantograph is defective, it must be down, and the lead pantograph must be up.
- A. HST Type I must be operated with the pantograph knuckles facing forward on both power cars for the direction of movement. When a pantograph with the knuckle facing forward is defective, it will be down and the pantograph with the rearward facing knuckle will be up.
 - B. NexGen HST must be operated with one pantograph up on the trailing power car, with the knuckle facing forward. Each power car is equipped with one pantograph assembly. Traction power will be supplied to the lead power car via a roof mounted high voltage link.
- 2.302 Under normal operations, trains in push-pull service should operate with pantograph knuckle facing forward.
- 2.303 An electric locomotive or HST Type 1 power car must not operate with both pantographs raised, except when directed by Train Dispatcher via a Double Pantograph Instruction.
- 2.304 Train Dispatcher must notify the Power Director before issuing Double Pantograph Instruction. The Train Dispatcher will notify adjoining dispatching territory, the Power Director, applicable supervision, and operations when issuing and removing a Double Pantograph Instruction.
- 2.305 A Double Pantograph Instruction will be issued verbally or by Form D and will remain in effect until it is cancelled.
- A. With Double Pantograph Instruction in effect, electric equipment operating individually must run with both pantographs up, except through Phase Break (when lit) and Dead Section. Drop all pantographs prior to entering the Phase Break and Dead Section locations.
 - B. HST Type I Engineers who receive a Double Pantograph Instruction must raise both pantographs on the lead power car only (Pantograph configuration of rear power car will not be affected).
 - C. Multiple Electric Engines coupled shall run with both pantographs up on the leading unit and rear pantograph up on each trailing unit.
- 2.306 When units of equipment are coupled, only one of the adjacent pantographs at the coupled ends should be up. The number of electric locomotives coupled and in service will be governed as outlined in AMT-2 3.103.
- 2.307 Electrical Equipment must not be stopped or positioned in such a way that would allow pantographs up or raised in a Section Break.
- 2.308 On Electric Equipment hauled "dead in tow" because of defective or damaged pantograph, the pantograph must be secured with no part extending above the latched down position (14'-8"). All pantograph-grounding switches will be in the OPEN position.
- 2.309 Electric Equipment with down pantographs must not be raised until receiving verbal permission from the Train Dispatcher, Yardmaster, or the Employee in charge of track(s), unless the action is solely for the purpose of reconfiguring the pantographs.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 2.310 The Train Dispatcher must be notified if the configuration of a locomotive's pantographs is changed and the reason for the change. The Train Dispatcher must notify Assistant Chief and Power Director of change. The Assistant Chief will make a log item of the occurrence.
- 2.311 Any Electric Equipment with a Main Circuit Breaker (MCB) must have the MCB opened prior to changing configuration of the pantograph, unless authorized by the equipment instruction manual to allow for simultaneous contact with the catenary.
- 2.312 Any Electric Equipment without an MCB will not change configuration of the pantograph(s) at the locations listed below until Power Director has been advised and a Plate Order has been completed to remove power:
- A. New York Division - Between west portal of Hudson (North) River Tunnels and east portal of East River Tunnels.
 - B. Mid-Atlantic Division, Harrisburg Station - Pantographs must not be dropped while on Station tracks No. 4, 5, 6, 7, and 8, inclusive, nor at Lancaster Station while under passenger bridge, or under other close overhead structures, except in case of emergency.
 - C. Philadelphia, 30th Street Station - Pantographs must not be dropped or raised while on Station tracks at 30th Street, except in case of emergency.
 - D. Baltimore - Pantographs must not be dropped on Station platform Tracks No. 1 through 8 inclusive, Track No. 1, 2, and 3 Union Tunnels, Track No. 2 and 3 B&P Tunnel, and between Howard Street and Guilford Avenue, except in case of emergency.
- 2.313 The Train Dispatcher may issue a Drop Pantograph Instruction Form D under the direction of field supervision that has determined it is safe to do so. The Form D will indicate tracks involved and limits of territory through which pantographs must be kept down. The Form D will be issued when:
- A. There is catenary damage or an obstruction that may impact the pantograph.
 - B. It has been determined that electric equipment can be safely operated under such catenary with pantographs down by an ET employee in the field.
 - C. Prior to entering the limits specified in the Drop Pantograph Instruction, all pantographs will be tested. When any pantograph fails to operate properly, or Drop Pantograph Instruction cannot be complied with, the equipment will be stopped immediately, and condition reported to the Train Dispatcher.
 - D. Electric equipment will not exceed speed of 30 MPH within the limits specified, unless otherwise stated in the Drop Pantograph Instruction Form D.
 - E. The pantograph DOWN button / Selector will be left in the DOWN position between the limits specified in Drop Pantograph Instruction Form D.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.4 Planned Signal Interruptions

- 2.401 Power Director must request permission from the Train Dispatcher prior to performing a planned signal interruption by informing them of the affected limits.
- 2.402 Prior to authorizing a signal flip, the Train Dispatcher must:
- A. Ensure that there are no trains in the affected area.
 - B. Fleet or place in stop position all interlocking and/or controlled point signals within the limits of the intended flip, to avoid having signals go into the slow-release mode.
 - C. Allow sufficient time to clear the TOL's that may appear, so as to not adversely affect train movement.

NOTE

TOL's resulting from a signal flip may be eliminated by displaying signal(s) away from the location of the TOL.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.5 Catenary or Third Rail Power Outages

- 2.501 When a catenary or third rail power outage occurs, the Power Director must notify the Train Dispatcher or Employee in charge of track(s) of the power outage limits and affected tracks.
- 2.502 After a catenary power outage, when two or more electric trains stop on the same track between the same two interlockings, the following train should not start until the preceding train has been moving for 30 seconds.
- 2.503 When a catenary power outage occurs and power is restored on the first attempt, train(s) within the affected catenary circuit must be instructed to proceed at normal speed to the next scheduled station stop to inspect pantographs.
- 2.504 When a catenary power outage occurs and power cannot be restored on the first attempt, train(s) within the affected catenary circuit must be instructed to stop and inspect pantographs for damage, unless the cause of the outage has already been determined.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.6 Pantograph Inspection and Damage

- 2.601 When practical, the condition of pantograph(s) must be observed by the engineer and/or train crew at every station stop. The Power Director and Train Dispatcher must be notified of any train with a defective pantograph(s). Any damaged pantograph found in route to New York must be inspected by an ET Class "A" Employee prior to proceeding toward the tunnels into New York.
- 2.602 HST Type 1 or trains running with double pantographs, a member of the train crew must be designated during their initial job briefing to observe rear power car pantograph and report condition to the engineer.
- 2.603 Engineers are responsible for taking corrective action when defects are identified and reporting issues to the Train Dispatcher.
- 2.604 When required to inspect pantographs due to power outage, the results of pantograph inspections must be reported to the Train Dispatcher and relayed to the Power Director.
- 2.605 Carbon strip will be considered worn if less than 1/8 inch to the metal channel remain and must be renewed on daily inspection.

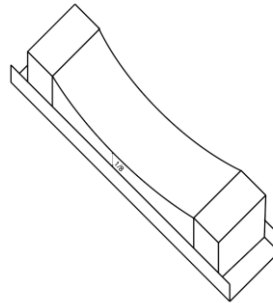


FIGURE 19 - WORN CARBON STRIP

- 2.606 Carbon strip will be considered damaged if:
- A. Chipped with less than 0.75 inches remaining of a 1.25-inch strip.

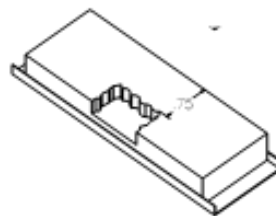


FIGURE 20 - CHIPPED CARBON STRIP

- B. Broken

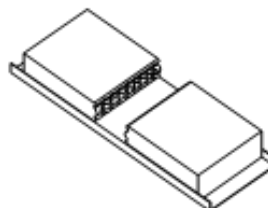


FIGURE 21 - BROKEN CARBON STRIP

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 2.607 When carbon strip damage occurs:
- A. The Engineer will inform the Train Dispatcher the status of the pantograph and reconfigure pantograph if possible.
 - B. Train Dispatcher notify and provide the Power Director the route of the equipment since last pantograph inspection and any additional information requested.
 - C. Train Dispatcher will direct an inspection be performed in accordance with AMT-2 2.701 on any tracks used by the engine since last pantograph inspection.
- 2.608 When a pantograph Auto Drop's or Broken Pantograph Alarm occurs Engineer will:
- A. Notify the Train Dispatcher
 - B. Inspect pantographs and report findings to Train Dispatcher
 - C. Reconfigure pantographs, if possible, inform Train Dispatcher, and await their instructions.
- 2.609 If a train is stopped with pantograph damage other than Carbon Strip Damage, the Train Dispatcher must immediately:
- A. Determine the type of damage sustained and the location of the train
 - B. Notify the Power Director
 - C. Direct an inspection be performed in accordance with AMT-2 2.701.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.7 Inspecting for Catenary or Third Rail Damage

- 2.701 When a catenary or third rail inspection is required, the Train Dispatcher must not permit trains to enter the affected area without receiving instructions to inspect for damage at the speeds shown:

TABLE 3 - CATENARY OR THIRD RAIL INSPECTIONS

Reason for Inspection	Track(s) Inspection Required	Inspection Speed*
AC or DC power outage with unknown cause, power restored on the first attempt	Affected Track(s)	Normal Speed
AC power outage with unknown cause, power not restored on the first attempt	All Tracks through the affected area	30 MPH Prepared to drop pantograph
DC power outage with unknown cause, power not restored on the first attempt	All Tracks through the affected area	Restricted Speed
Train reported with carbon strip damage	Tracks used by engine since last pantograph inspection	Normal Speed
Train reported with damage other than carbon strip damage	All tracks 5 miles to rear of train	30 MPH Prepared to drop pantograph
If necessary, Power Director may request a slower inspection speed.		

- 2.702 When instructed to inspect for catenary damage, trains must:
- Inspect the Overhead Catenary System for defects on the track they are operating (or an adjacent track(s) if so instructed) within the limits specified.
 - Operate at an inspection speed of 30 MPH, unless otherwise directed by the Train Dispatcher.
 - When operating at 30 MPH always be prepared to drop pantographs.
 - Report the results of their inspection to the Train Dispatcher or Operator when clear of the specified limits.
- 2.703 When instructed to inspect for third rail damage, trains must:
- Inspect the third rail infrastructure for defects on the track they are operating (or an adjacent track if so instructed) within the limits specified.
 - Report the results of their inspection to the Train Dispatcher or Operator when clear of the specified limits.
- 2.704 Results of infrastructure inspections must be relayed to the Power Director by the Train Dispatcher.
- 2.705 Power Directors may waive the requirement for trains to inspect the catenary or third rail if a Class "A" Employee has performed a visual inspection of the affected area from the right of way.
- 2.706 Catenary or third rail inspections directed by the Train Dispatcher are to remain in effect until a train has performed a complete inspection and either the cause of the power outage has been determined or the train reported "no exceptions taken" on the affected track(s). The Train Dispatcher and/or Power Director may require additional inspections depending on the circumstances of the outage.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.8 Sleet/Extreme Weather Instructions

2.801 Sleet Instructions:

- A. When sleet formation on the pantograph or overhead catenary system causes excessive arcing, the Engineer/Employee must promptly report the condition to the Train Dispatcher/Power Director.
- B. The Train Dispatcher will inform the Power Director of reported condition and vice versa.
- C. The Train Dispatcher will issue a Double Pantograph Instruction on a train-by-train basis.
- D. The Engineer/Employee will promptly inform the Train Dispatcher/Power Director of changes to the sleet conditions and when it is determined that sleet conditions no longer exist, the Train Dispatcher will remove the Double Pantograph Instruction and Engineer will resume normal pantograph configuration at next station stop.
- E. Electric Equipment in yards, storage tracks, or standing at any point, should have pantographs lowered and raised frequently to prevent accumulation of sleet. Electric equipment left unattended shall have pantographs lowered to prevent arcing caused by sleet formation.
- F. When a pantograph lowers due to sleet, or when sleet load on a pantograph becomes excessive resulting in heavy arcing between shoe and wire, open the Main Circuit Breaker (MCB) and attempt to raise and lower the pantograph several times. If this fails, the Train Dispatcher must be advised and arrangements made to de-energize, test de-energize, and ground catenary before sleet can be removed.

2.802 High Wind Instructions:

- A. If sustained wind speeds above 50 MPH are encountered, electric trains must be instructed to operate at a reduced speed of 60 MPH and be on the lookout for debris in the catenary or right of way.
- B. If sustained wind speeds above 60 MPH are encountered, electric trains must be instructed to operate at a reduced speed of 60 MPH, be on the lookout for debris in the catenary or right of way. and proceed to the nearest terminal to stop until wind speeds fall below 60 MPH.
- C. The limits of the restriction will be provided to the Movement Office by the Deputy Chief Engineer – ET or their designated representative. Train Dispatchers will issue Form D or Temporary Speed Restriction Bulletin additions placing the above restrictions in effect.

2.803 Extreme Temperature Instructions: During periods of extreme high or low temperatures, extra precautions must be taken by making additional inspections to determine that both the catenary and the third rail systems are in proper condition, free of obstructions or broken hardware.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.9 Electric Power Restrictions

- 2.901 When the Load Dispatcher determines a reduction in power consumption is necessary, the Load Dispatcher will inform the Power Director of the limits of the restriction. The Power Director will inform the Train Dispatcher of the limits of the Power Restrictions. This restriction will be issued verbally or by Form D and will remain in effect until it is cancelled by Train Dispatcher (or Operator when authorized by the Train Dispatcher). The Power Restrictions can be found in the table below:

TABLE 4 - ELECTRIC POWER REQUIREMENT RESTRICTIONS

Equipment	Controller Position/Power Effort Must Not Exceed:	Notes
NexGen HST	75% Tractive Effort	...
HST Type I Power cars	50,000 foot-pounds	...
HHP-8 Engines	50,000 foot-pounds	...
AEM-7 (AC) Engines	7,500 foot-pounds per traction motor	...
AEM-7 (DC) Engines	1,500 Amps	...
ALP-44 Engines	1,500 Amps	...
ALP-45 Engines	1,500 Amps	1, 2
ACS-64	50,000 foot-pounds	...
ALP-46 Engines	1,500 Amps	1
MU Cars	P-2 Position	...

Note 1: Total line amperage can be viewed on ITU Propulsion Screen.

Note 2: This notching restriction only applies when this engine is operating in electric mode.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2.10 Plate Order

- 2.1001 Plate Order Form (NRPC 2990) will be utilized for documenting the Plate Order when electronic means are not available. All Blocking Devices being applied and/or removed for a plate must recorded on this form when electronic means are not available. Requirements of the Plate Order Form (NRPC 2990) that are applicable to the "Train Dispatcher" are applicable to yardmaster or Employee(s) in charge of track(s).
- 2.1002 When required to remove catenary or third rail power from Electrified Territory, the Power Director will determine the proper power sectionalizing and Plate(s) necessary to establish appropriate coverage. AC, DC, or Solid Holds may be issued in Emergency Conditions or where circuits are to remain ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE), but track is to be restricted from electrical movements.
- 2.1003 The Power Director will request a Plate through the Train Dispatcher(s), Yardmaster and/or Employee(s) in charge of track(s), informing them of Plate designation and/or page number. The Train Dispatcher(s), Yardmaster and/or Employee(s) in charge of affected track(s) must use the appropriate schematic to determine the required holding and diverging points. Should multiple Employees be in charge over portions of the affected tracks, all must participate in the Plate Order process and ensure adequate protection prior to issuing the Plate Order.
- 2.1004 Prior to issuing or approving a Plate the Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) must ensure:
- A. The affected track is clear of AC, DC, or All movements as required by type of hold.
 - B. Verified that all pantographs are down and secured and/or third rail contact shoes have been removed. When the pantograph or third rail shoe cannot be retracted, the Main Circuit Breaker on the train must be opened and tagged with Do Not Operate Tag - Plate Tag (NEC 106).
- AND
- C. Ensure that the proper Blocking Devices are in place to properly protect the affected track(s).
- 2.1005 Non-Controlled Track where No Employee is in charge: When a plate is within a yard where a Yardmaster is not assigned, the local Yard Bulletin and Special Instructions will govern and describe how the track(s) will be protected by the person in charge of track. Unless otherwise prescribed, a plate encompassing the entire yard will be issued by Train Dispatcher to the Power Director, restricting all electric movements into the yard, and will be protected by the Train Dispatcher at the last point(s) of entry from controlled track territory.
- 2.1006 Non-Controlled Track where an Employee is in charge:
- A. After receiving a request from Power Director to remove power from a yard and prior to granting permission to remove power from affected non-controlled tracks, the Yardmaster or Employee in charge of over affected track(s) must issue a Plate directly to the Power Director by:
 - 1) Line away, lock and place Do Not Operate Tag - Plate Tag (NEC 106) in the Yardmaster or Employee in charge over affected track(s) name with their contact information on hand-operated switches leading from normally energized tracks equipped for electrical movements to de-energized tracks.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- i. When a de-energized section cannot be protected by aligning and locking the track switches away from the affected area, a derail or an AC Motor Stop Sign must be clamped, locked and tagged to the rail.
- 2) When Plate(s) involve coordination with a Mechanical Facility, the Mechanical Department Worker in Charge will verify with the Yardmaster or Employee in charge over affected track(s) that the affected Plate is protected by means of ensuring no pantographs are raised and that electric equipment is properly secured to prevent operation, or the Mechanical Facility has cut catenary and/or third rail power not to be restored until permission from the Yardmaster or Employee in charge over affected track(s) is granted.
- 3) Record assurance of such protection on Line 5 of the Plate Order Form (NRPC 2990).

NOTE

RWP and/or Blue Flag Protection may need to be completed in addition to requirements above but not in lieu of.

- B. Any removal of protection listed on the Plate Order Form Line 5 of side A, while a Plate Order is in effect, must be verified for non-electric movement and have the Yardmaster or Employee in charge over track(s) approval to remove and reapply the protection. The Person in Charge must record this information on the top section of Side B Plate Order in effect.
 - C. No ET employees may throw track switches/derails for the movement of trains.
- 2.1007 Should Dual Tone Modulated Frequency (DTMF) Radio Controlled Track Switches be required for use as blocking points, the radio control must be disabled by an employee prior to the track switch being lined, locked, and tagged with Do Not Operate Tag - Plate Tag (NEC 106).
- 2.1008 Before allowing equipment to enter the affected track Plate Limits the Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) must:
- A. Direct and record the temporary removal of blocking or the lining of affected switches to allow equipment unrestricted by the Plate to move within the area affected (when required).
 - B. Ensure that all electric equipment equipped with pantographs are lowered and locked and/or no third rail shoes are in contact with the third rail in the area affected by the plate. When the pantograph or third rail shoe cannot be retracted, the Main Circuit Breaker on the train must be opened and tagged. Example:
"Amtrak section six dispatcher to NJT 4605, the catenary is de-energized on No. 3 track between Shore and Clearfield. Do you have any raised pantographs on your train/consist? Over."
- AND
- C. Direct, record (if electronic means are not available), and ensure the reapplication of blocking devices applied to the controls of switches and signals leading to the affected track after the move has been completed to re-establish the Plate protection.
- 2.1009 When protection is no longer required, the Power Director will notify and coordinate the final release of the Plate with the Train Dispatcher(s), Yardmaster and/or Employee(s) in

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

charge over affected track(s). Once the Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) annuls the Plate Order, they will notify the affected employees.

- 2.1010 In the event of an emergency, the Power Director will notify the Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) and identify the type and limits of the required protections.
- 2.1011 The Power Director will place an Emergency Plate in effect via SCADA system when available OR direct the Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) to apply an Emergency Plate Order or an AC, DC, or Solid Hold over the affected tracks.
- 2.1012 The Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) protected by an Emergency Plate, must attempt to stop (by radio) any electric moves that are routed into the affected territory, hold appropriate trains clear of and apply blocking devices to the controls of switches and signals leading to the affected track.
- 2.1013 If an Emergency Plate Order or an AC, DC, or Solid Hold cannot be immediately restored, a Plate Order must be issued by Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s).
- 2.1014 Trains stopped within the limits of the Emergency Plates/Holds, may be moved under verbal permission of Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s). Prior to issuing permission, Train Dispatcher(s), Yardmaster and/or Employee(s) in charge over affected track(s) must receive permission from Power Director:
 - A. Exact position of Train's Pantographs / Third Rail Shoes.
 - B. The status of the Catenary/Third Rail in the train's path.
 - C. Any additional restrictions for movement.

3. Rules and Instructions Pertaining to Mechanical Activities

3.1 Electric Engines

- 3.101 The operation of more than two (2) electric locomotives, except MU cars, in a train is prohibited. When there are more than two electric locomotives in the consist, the remaining units will not provide traction power.
- A. AEM-7-DC units will be live-in-tow, unless defective.
 - B. HHP-8 units, ACS-64 units, and HST Type 1 will be dead-in-tow (pantograph(s) down) with 480 V power to locomotive(s) or train.
 - C. NexGen HST is designed to be towed in a dead/de-prepared state. The trainset does need some low voltage power to release the parking and emergency brake via train batteries, in the event the batteries are fully discharged:
 - 1) A rescue generator can be installed to provide low voltage.
 - OR
 - 2) Continuity must be established between the brake pipes of the rescue unit and the NexGen HST such that service brake, penalty brake, and emergency brake commands apply.
- 3.102 Locomotives or trainsets in tow must be moved as follows:
- A. AEM-7-DC Units: Pantograph is to be up, unless damaged. 27-Point MU cables and 480 V cables must be connected between units. Brake pipe, main reservoir, and all MU hoses must be connected. Main Circuit Breaker is to be closed. HEP and APL converters are to be switched off, and traction power is to be "isolated". Traction motors should not be cut out.
 - B. ACS-64 Units: Pantograph(s) must be down. 27-Point MU cable and 480 V cables must be connected between units. Brake pipe, main reservoir, and all MU hoses must be connected. The HEP control switch should be set to HEP line. The emergency magnet valve must be cut out.
 - C. HHP-8 Units: Pantograph(s) must be down. 27-Point MU cables and 480 V cables must be connected between units. Brake pipe, main reservoir, and all MU hoses must be connected. The emergency magnet valve must be set to "IN", and the pantograph selector must be set to "OFF".
 - D. HST Type 1: must not be coupled together. When a locomotive tow's a HST Type 1, pantographs must be down, and 480 V cables must be connected between locomotive and trainset. Main reservoir and brake pipe must be coupled. The emergency magnet valve must be set to "IN", and both power cars must have pantograph selector set to "OFF".
 - E. NexGen HST: Pantograph(s) must be down. Type 10 automatic couplers must be connected between units allowing for the mechanical, pneumatic, and electrical coupling of two trainsets. 480 VAC cables cannot be applied to the trainset when being towed by a locomotive.

NOTE

When making light electric engine moves, while pantographs are up, between Ivy City and Washington Terminal the following will apply:

- A maximum of six electric engines will be allowed in a consist.
- The 27-point MU cable requirement listed above, is not required. When handling more than three engines, operating speed must not exceed 15 MPH.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 3.103 The maximum number of Electric MU cars are as follows:
- | | | |
|----|------------------------------|----|
| A. | New York to Washington, D.C. | 12 |
| B. | Philadelphia to Harrisburg | 10 |
| C. | ConnDOT M8 | 8 |
- 3.104 When necessary to inspect or test single or coupled energized electric engines or MU cars, a Class "B" Employee must take charge. Others assisting with such work must be governed by the Class "B".

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

3.2 Mechanical Facilities

- 3.201 Pantographs, pantograph ground switch, Main [Circuit Breaker \(MCB\)](#), etc. must not be operated in a Mechanical Facility until known that all persons, tools, and equipment in the vicinity of the electric equipment are clear, all personnel have been briefed and understand what is to be operated and its effect on the equipment and/or Overhead Catenary System.
- 3.202 Personnel must not work/operate equipment on the locomotives, MU cars, or equipment that in doing so would place them within the Minimum Approach Distance of a buffer zone or section break unless Protection is provided by an ET Class "A" Employee via a Clearance or when working under a documented procedure approved by the Deputy Chief Engineer - ET or their designee.
- 3.203 EP 7051 establishes a procedure to obtain and manage a Clearance when working or providing Protection within the Sunnyside Yard High Speed Rail Building.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

3.3 Head End and Wayside Power

- 3.301 Repair work on or near main power circuits on electric engines or MU cars must not be performed under ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) wire until all pantographs have been lowered, grounding switches have been closed, and Do Not Operate Tag - Red Tag (NEC 105) have been applied by the Class "A" holding a Clearance or Mechanical warning tags have been applied by a Class "B" Person. Other Employees performing this work must obtain permission from a Class "A" or "B" Personnel before starting work and must advise the Class "A" or "B" Personnel when work is completed. Mechanical warning tags must be removed by the Class "B" Person who applied them. Grounding switches must not be opened until tags are removed and it is known that all persons are clear of main power circuits.
- 3.302 Electric equipment may only be plugged into wayside power stations after pantographs are lowered. Pantographs may not be raised until wayside power is removed.
- 3.303 Only qualified and authorized personnel may operate and/or connect engines to wayside power.

4. Rules and Instructions Pertaining to Electric Traction Activities

4.1 General

- 4.101 Prior to start of a shift, ET Employees or Person in Charge must advise the Power Director / Load Dispatcher of personnel working in the assigned territory and any planned work. Any changes to the planned work must be communicated to the Power Director / Load Dispatcher. At the end of a shift, ET Employees or Person in Charge must advise the Power Director / Load Dispatcher work is completed.
- 4.102 When working at heights, ET Trainees must not be the first person allowed to ascend, or be the last person to descend from, equipment and/or structures, unless continually visually observed by an ET Class "A" Employee after being discussed and noted on the Job Briefing.
- 4.103 Class "A" ET Trainees must not allow personnel to work under their direction; receive a Clearance, Work Permit, Third Rail DC Power Permit UNLESS under the guidance of an AMT-2 Qualified ET Class "A" Employee after being discussed and noted on the Job Briefing.
- 4.104 In the circumstance where an ET Class "A" Trainee is taking a Clearance, Work Permit, Or Third Rail DC Power Permit under the guidance of a Class "A" Employee, the Power Director will issue such instructions to both individuals.
- 4.105 In addition to requirements in the Amtrak Employee Safety Rulebook, ET employees are governed by SOI-219, ensuring they are adequately prepared to provide immediate first aid and emergency assistance.
- 4.106 EP 7058 establishes a uniform procedure for formatting, issuing, and distributing ET Letters and Memos by the Electric Traction Department Managers and Supervisors.
- 4.107 ET Maintenance and Inspection Manuals must be followed when performing regular and standardized inspection / maintenance of Electric Traction Systems.
- 4.108 Prior to providing Protection, ET Class "A" Employees must contact and inform Power Director of relevant information including but not limited to:
- A. Scope of work
 - B. Designation of circuit/apparatus to be worked on or near.
 - C. Limits of Protection / Work Area
 - D. Time required to perform work
 - E. Time necessary to clear-up work
 - F. Number, type and/or exact location of any temporary protective grounding devices, raised pantograph, jumpers and/or third rail warning devices to be applied.
- 4.109 When working on or near a circuit/apparatus equipped with an auto-reclose feature, it must be disabled prior to work.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- 4.110 When providing Protection, ET Class "A" Employees must:
- A. Place themselves in a position which will permit observation of all locations within proximity to the energized circuits, from which they can communicate without an electronic device, observe the movement of all personnel toward such locations, stop movement if necessary to protect personal and all electric traction systems from damage. If they are unable to observe or verbally communicate with all personnel in work area they must assign, and place other ET Class "A" Employees as needed.
 - B. Ensure another qualified person is transferred the responsibility before leaving a job site. If a qualified person cannot be present, all work in the vicinity of the circuitry or apparatus must cease and all persons/equipment must maintain Minimum Approach Distance.
 - C. Stop all work in the area and notify Power Director, if anyone in the group does not understand or comply with their instructions.
 - D. Not engage in any work themselves, nor shall they converse with personnel, any more than is necessary when providing protection to personnel of Class "B", "C" or "D".
 - E. Notify the Power Director, when work cannot be completed in the time allotted.
 - F. Maintain vigilance around insulators and section breaks on adjacent energized wire and control personal movements and tools to avoid encroaching upon Minimum Approach Distance.
 - G. Before releasing Protection, make a thorough check and be sure that:
 - 1) All persons, tools, Temporary Protective Grounds are clear of the Limits of Protection / Work Area,
 - 2) Circuits/apparatuses are in a safe condition for electric operation,
AND
 - 3) Any changes to Amtrak infrastructure have been communicated to Power Director.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

4.2 ET Components

- 4.201 Always clearly identify and tag any and all wires or connection before disconnecting.
- 4.202 Use all means possible to identify cables utilizing prints/schematics, tags or labels, duct records, or following out the cable.
- 4.203 If an improperly labeled cable is found, corrections must be made immediately, and the Power Director informed.
- 4.204 When cutting, parting, or unreeling wire, secure ends to avoid injury from sudden release of tension and wire returning to its spooled position.
- 4.205 When unreeling wire, tend reel from the side of reel being pulled.
- 4.206 Follow SOI-221 when working around antenna transmitter sites.
- 4.207 EP 7008 provides procedures for operation and maintenance of underground signal power cable.
- 4.208 EP 7018 establishes uniform procedures for the removal and installation of fuses housed in fuse cutouts energized at 25kV or less.
- 4.209 EP 7021 establishes a uniform procedure for operation and maintenance of signal power cut sections.
- 4.210 EP 7027 serves as an installation guide to assist in the preparation and installation of cable trough installed on Amtrak railroad property.
- 4.211 EP 7029 provides a general guideline for the installation of conduit.
- 4.212 EP 7031 summarizes concepts and procedures for erecting steel catenary structures. Considerations for installation preparation, technique, craftsmanship, bolting, and hoisting and rigging are addressed.
- 4.213 EP 7032 provides guidelines for replacement and installation of disconnect switches and their motor mechanisms.
- 4.214 EP 7033 provides a general guideline for the pulling of cable.
- 4.215 EP 7035 provides an overview of several types and applications of ET lightning arresters, along with considerations for installation and maintenance.
- 4.216 EP 7036 provides uniform guidance and direction for the safe repair of damaged and/or broken wires (catenary, signal power, transmission wires).
- 4.217 EP 7038 provides uniform guidance for the safe installation of pre-cast foundations used to support substation and wayside electrical equipment.
- 4.218 EP 7040 provides uniform guidance for the application, installation, and maintenance of insulators.
- 4.219 EP 7042 outlines procedures for installing and testing various ground grids and mats for electric traction equipment.
- 4.220 EP 7053 defines several types and methods of power cable termination, splicing, and shield-grounding.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

4.3 Control Houses and Remote Terminal Unit (RTU) Huts

- 4.301 Modification of relays or other protection devices related to the electric traction system will only occur under the direction of ET System Office.
- 4.302 Upon entering any ET enclosure, ET employees will:
- A. Visually check indications on the control boards.
 - B. Depress ground lamp button (when equipped) and note any difference in the brightness of the ground lamps. Depress Lamp Test Button (when equipped) and observe lamps for burnt out bulbs and replace bulbs when applicable.
 - C. Note readings on voltmeter and other indicating meters.
 - D. Report any relay targets to the Power Director or Load Dispatcher prior to resetting.
 - E. Any abnormal condition must be reported immediately to the Power Director or Load Dispatcher.
- 4.303 Operation of control switches must be completed per SOI-224 Electrical Switching and Tagging.
- 4.304 EP 7045 establishes a uniform procedure for the rehabilitation of 25Hz Substation Control Houses, and more specifically, Distribution Panels, Batteries, Battery Chargers, Bus Work, Transition Cabinets, and RTUs.
- 4.305 EP 7046 provides a general overview, commissioning, and troubleshooting guide for Microsol and QEI remote terminal units (RTU).
- 4.306 EP 7047 establishes a uniform procedure for installation of new Remote Terminal Unit (RTU) Huts and Wayside Power Cubes (WPC) at all interlockings.
- 4.307 EP 7054 establishes a unified procedure for installation methods of control wiring.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

4.4 Line Work

- 4.401 On curve or corner, when pulling wire, cable, or rope into position, or when releasing it from position, employees must keep to the outer side of the curve, if practical.
- 4.402 When renewing catenary wire on a curve, secure new wire to old wire at each hanger location to prevent wire from fouling train on adjacent track.
- 4.403 Securely fasten catenary or other wire after stringing before attempting to work on or about it.
- 4.404 Install a guy-wire or secure crossarm on which there is likely to be unbalanced pull before dead-ending wires or removing wires which could cause excessive slack or pull.
- 4.405 When pulling trolley and auxiliary wire together, attach rigging to each wire.
- 4.406 Ensure that rigging is tightly secured to wire or cable and marked before applying strain.
- 4.407 When working on a Section Break or Section Insulator, both sides of break must be protected via a Clearance.
- 4.408 ET Class "A" Employees operating a Roadway Maintenance Machine in the process of testing de-energized and applying temporary protective grounds on de-energized transmission circuits may breach 15 feet Minimum Approach Distance but not closer than 8 feet.
- 4.409 When work requires Protection be provided by a Utility Company:
 - A. Grounds must be visually verified prior to start of work, or
 - B. A Utility Company representative must be on site to verify the wires are de-energized and grounded.
- 4.410 ET Employees may breach 3 feet but no closer than 18 inches of catenary, signal or circuits below 30,000 volts for inspection purposes only, after being discussed and noted on the Job Briefing.
- 4.411 EP 7016 establishes a uniform procedure for performing running catenary inspections from a Cat Car.
- 4.412 EP 7014 provide guidelines for establishing passing clearance (distance from wire) for equipment and are to be used in conjunction with the clearance routes outlined in the Amtrak Northeast Corridor Employee Timetable Special Instructions as outlined in the NORAC Operating Rules current edition. The parameters included herein are intended to assist the clearance department in its designation of minimum trolley heights.
- 4.413 EP 7024 provides guidance for the safe installation of catenary section insulators, including low-speed and high-speed.
- 4.414 EP 7030 establishes a uniform procedure for the use of telescoping height sticks and catenary measurement devices for the purpose of obtaining existing or "as-built" catenary information such as height and stagger.
- 4.415 EP 7034 provides guidance for the safe installation of Steady and Pull-off (SAP) Assemblies.
- 4.416 EP 7039 provides uniform guidance for adjusting both new and existing catenary wire heights and staggers.
- 4.417 EP 7041 provides uniform guidance for the removal of trees from catenary, transmission, and/or signal power lines.
- 4.418 EP 7043 provides uniform guidance for the safe installation of fixed termination catenary systems.
- 4.419 EP 7044 provides uniform guidance for the safe installation of constant tension catenary systems.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

4.5 Substation / Frequency Converter Work

- 4.501 Substation / Frequency Converter Stations Manuals and Procedures must be readily available on site.
- 4.502 All operations involving frequency converters or related electrical, mechanical, or hydraulic equipment must be conducted under permission of Power Director / Load Dispatcher:
- 4.503 Frequency converters shall only be reset by a Class "A" Employee qualified at the frequency converter station or under the direction of the ET System Office.
- 4.504 Frequency converters that have been repaired and made ready shall be placed back into operation as soon as possible unless under the direction of ET System Office.
- 4.505 Converters will not be placed back in service without all relay and protection operating as designed.
- 4.506 At frequency converter stations, a clearance or a work permit is required to enter:
 - A. Neutral Ground Resistor fenced off areas
 - B. Filter bank areas
 - C. Converter Rooms
- 4.507 SOI-216 details the procedures used when entering indoor facilities containing SF6 Gas Insulated Switchgear (GIS).
- 4.508 When it becomes necessary to add or remove SF6 gas from breakers or bus work, an approved method of handling must be used. SF6 gas must not be dispersed into the atmosphere.
- 4.509 EP 7019 outlines the types of electrical equipment using SF6 for insulation and arc quenching, details safe handling practices, and provides the Electric Traction Department's maintenance standards for such equipment.
- 4.510 When operating disconnect or ground switches on SF6 switchgear, the switch contacts must be visually checked through the view ports or camera system to ensure all contacts operated correctly. Never look directly into view ports of switches that are being operated.
- 4.511 EP 7037 provides general guidelines for the installation and maintenance of vacuum circuit breakers.
- 4.512 When closing an energized circuit breaker by hand, close contacts as quickly as possible.
- 4.513 EP 7008 contains procedures for operation and maintenance of 6.9kV/120V/240V padmount transformers.
- 4.514 EP 7025 provides a general guideline for the operation, replacement, installation and maintenance of stepdown transformers.
- 4.515 The secondary circuit of energized current transformer must not be opened.
- 4.516 Before working on a Potential Transformer (PT), remove the primary fuses or open the switches on the primary side and open secondary circuit.
- 4.517 EP 7026 establishes a uniform procedure for troubleshooting and resolving common relay issues at a step-down substation. It will outline the common types of relays, how

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

they work and probable causes of failure. The document is primarily focused on the 25Hz network however the basic principles apply to all relays.

- 4.518 EP 7056 describes how modern microprocessor relays are used to provide the typical protection schemes required throughout the Mid-Atlantic and New York Divisions.
- 4.519 EP 7052 establishes a uniform procedure for the installation, operation, and maintenance of the sump pumps.
- 4.520 Rotary signal machines must not be worked on until a work permit is received per SOI-209 and the rotating machinery has stopped, except when performing testing, troubleshooting, voltage measuring, visual inspections and/or general housekeeping of machines.
- 4.521 EP 7023 provides guidelines for pre-use inspection, operation, and maintenance of the Nova (Jupiter Series) static frequency converter.
- 4.522 EP 7028 establishes a uniform procedure for the installation, operation, and maintenance of unit substations on the Mid-Atlantic and New York Divisions.
- 4.523 EP 7013 establishes a uniform procedure for electrical power and control cable megger (insulation resistance) testing.
- 4.524 EP 7015 provides uniform guidance for the safe use of the Doble M4100 testing instrument on main power transformers.
- 4.525 EP 7057 outlines procedure for the calibration of electrical testing equipment.
- 4.526 Before working on electrically operated apparatus or equipment, open the control cut-out switch and remove DC control power. If the apparatus or equipment does not have a control cut-out switch, remove fuses, or block operating contactors in switch open.
- 4.527 Only ET employees qualified in specialty testing positions per SOI-205 may remove or direct the removal of temporary protective grounds during the test procedure, after they have ensured all personnel are using appropriate insulating equipment, isolated from any hazards involved, and have implemented any additional measures necessary to protect each exposed person in case the previously grounded lines and equipment become energized as documented on a job briefing.
- 4.528 When racking breakers in and out onto ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE) bus gear remote racking equipment must be utilized, when available. When not available or in good working order, Arc Rated Category 4 flash suit jacket and pants with flash suit hood and appropriate rubber insulated gloves with leather gauntlets per SOI-201 must be worn.

4.6 Capacitors

All rules in section refer to capacitors and devices with stored energy that are applied to circuits normally energized above 480 volts.

- 4.601 Any capacitor showing signs of bulging or leakage must be taken out of service immediately and reported to the Power Director.
- 4.602 Before working on capacitors or equipment with stored energy, obtain Clearance.
- 4.603 Barricade the work area when working on or testing capacitors in a shop environment.
- 4.604 Before grounding, wait 10 minutes after de-energizing for capacitors to fully discharge to 50V or less.
- 4.605 Do not rely on circuits equipped with bleed resistor systems to discharge capacitors.
- 4.606 For capacitors, apply grounds to all phases to ensure that all charges are properly dissipated.
- 4.607 Grounds and terminal shorts on capacitors must be left connected until the work is completed.
- 4.608 Do not reenergize a capacitor that is shorted terminal to terminal, shows signs of physical damage, or has a measured capacitance outside of the designed range.
- 4.609 Wait 10 minutes before reenergizing a capacitor bank after circuits have been de-energized.
- 4.610 Store or dispose of capacitors with their terminals shorted.

5. Rules and Instructions Pertaining to Power Directors and Load Dispatchers

5.1 General

- 5.101 The Power Directors/Load Dispatchers must perform and document, while being physically present, a Shift Turnover during each transfer of authority on an operating territory.
- 5.102 Clearances, Work Permits, or Third Rail DC Power Permits must be numbered consecutively beginning each calendar year.
- 5.103 The Power Director and Load Dispatcher are responsible for coordinating and maintaining an accurate record of all Switching Operations, Clearances, Work Permits, Third Rail DC Power Permits.
- 5.104 The Power Director must report and document to the Train Dispatcher, relevant conditions and anomalies that have the potential to affect electric train operations.
- 5.105 The Power Director/Load Dispatcher are responsible to identify, report, and document all system disturbances and occurrences on the Amtrak Electric Traction System through ET Logbook.
- 5.106 The Power Director/Load Dispatcher must establish positive contact with appropriate ET Management and System ET and promptly document any violation of the AMT-2 in the ET Logbook, indicating incident details and the name of the manager.
- 5.107 All communication with Power Director/Load Dispatcher must be on a recorded line.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

5.2 Orders and Directions

- 5.201 Power Director/Load Dispatcher Operating Procedures must be readily available at each desk.
- 5.202 The Power Director/ Load Dispatcher must not issue any switching orders to any person who is not on the Class "A" Qualified and Authorized List.
- 5.203 The Power Director/Load Dispatcher will STOP any instruction should there be a difference of opinion or meaning until every effort has been made to reach an understanding. The Power Director and Load Dispatcher are empowered to stop any work task if orders or directions are not understood or qualifications to perform work are in doubt. If an understanding cannot be reached to the satisfaction of the Power Director and Load Dispatcher, the issue must be referred to the Class "A" Employee's supervisor before proceeding and escalated to appropriate Power Director/Load Dispatcher Manager. Documentation of this must be through the ET Logbook.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

5.3 Operation of Electrical Devices

- 5.301 The Power Director/Load Dispatchers will notify substation personnel prior to operating any equipment at or in a substation where personnel are known to be present.
- 5.302 The Power Director/Load Dispatchers will not restore power when a power interruption occurs in the area where personnel are known to be working until contacting the employees or the Person in Charge on-site and it has been verified all personnel and equipment are in the clear and safe.
- 5.303 The Power Director will maintain separation of signal power sources while performing operations on signal circuits and devices.
- 5.304 When re-energizing a circuit/apparatus the Power Director/Load Dispatcher will verify all Mechanical Ground Switches within the affected circuit are in the open position.
- 5.305 When practical, manually operated third rail switching and jumper operations should be conducted with minimal load on the affected circuits by Power Director discussing with Train Dispatcher.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

5.4 Issuing Power

- 5.401 The Power Director/ Load Dispatcher will determine if conditions permit the granting of the Clearance, Work Permit, or Third Rail DC Power Permit request and will ensure all parties affected are appropriately notified in accordance with these rules.
- 5.402 The Power Director will not issue any Clearances, Work Permits, or Third Rail DC Power Permits to any person who is not on the Class "A" Qualified and Authorized List. In the circumstance where a Class "A" ET Trainee is taking a clearance or permit under the guidance of a Class "A" Employee, the Power Director will issue such instructions to both individuals.
- 5.403 Where the rules require Power Directors to record the application of tags, they must verify with the Class "A" Employee that the tags applied afford the necessary protection.
- 5.404 Only after the Power Director is satisfied that all switching and tagging has been done properly, will a Clearance, Work Permit, or Third Rail DC Power Permit be issued/transferred.
- 5.405 SCADA tags must not be removed from blocking devices unless the associated Clearance, Work Permit or Third Rail DC Power Permit has been released.
- 5.406 The Power Director/Load Dispatcher will direct the removal of all tags and operation of all ground switches.

Exemption

Ground Switches being operated within site-specific catenary isolation procedures.
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- 5.407 The Power Director will not issue any Clearance or Third Rail DC Power Permit until a mechanical ground switch has been verified closed, or testing de-energized is completed by the Class "A" Employee, unless an alternate work plan has been approved by the Deputy Chief Engineer – ET or their designated representative.
- 5.408 Where the rules require primary circuits/apparatus to be de-energized under the Load Dispatcher's direction, the Load Dispatcher must ensure switching will disconnect and isolate designated primary circuit/apparatus as outlined in the Load Dispatcher Permit description.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

6. Contact Numbers

1) Amtrak Emergencies

TABLE 4 - AMTRAK EMERGENCY NUMBERS

For Emergencies	Number
Police – All Locations	1-800-331-0008
Boston CETC	1-800-243-1255
New York CETC	1-800-530-2075
Wilmington CETC	1-800-446-9672

2) C&S Trouble Desk

TABLE 5 - C&S TROUBLE DESK TELEPHONE NUMBERS

Division	Number
New England	617-345-7502
	212-630-7651
New York & Mid-Atlantic	302-552-4671
	215-349-2271
	215-349-2272

3) Train Dispatchers, Operators, etc.

TABLE 6 - TRAIN DISPATCHERS, OPERATORS, ETC. TELEPHONE NUMBERS

Train Dispatcher/Operator	Exchange	Commercial	Radio Channel
NHB, DB, MRS, & MM LINES			
Chief Dspr	Boston	617-345-7569	...
	...	617-345-7570	
Form D inquiry only	Boston	617-345-7585	
Terminal TD	Boston	617-345-7565	054-054 063-063
Corridor TD	Boston	617-345-7561	054-054
Main Line TD	Boston	617-345-7562	
New London TD	Boston	617-345-7567	
South County TD	Boston	617-345-7580	
Dorchester TD	Boston	617-345-7492	063-063
Shore Line TD	Boston	617-345-7568	054-054
North End - Springfield Line TD	Boston	617-345-7521	
Springfield Line TD	Boston	617-345-7574	
Conn	New London	860-510-5622	
Mystic River	New London	860-446-3908	
Nan	New London	860-510-5628	
NYS, HUD, PRB, NGB, NYT & NYP LINES			
Chief Dspr	Penn Sta.	212-630-7467	...
Penn Station Central Control	Penn Sta.	212-630-6308	054-054
		212-630-6309	060-060
		212-630-6286	LIRR Channel 2 STA/TUN/RPTR
Terminal Operator Control	Penn Sta.	212-630-6466	054-054 060-060
PSCC Yardmaster	Penn Sta.	212-630-7492	
Dspr. Sec. A	Penn Sta.	212-630-7472	
Dspr. Sec. B	Penn Sta.	212-630-7471	
CETC-9 TD	Penn Sta.	212-630-6881	
CETC-8 TD	Penn Sta.	212-630-6409	
CETC-7 TD	Penn Sta.	212-630-6408	
Hudson Line TD	Penn Sta.	212-630-7370	

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Hudson North TD	Penn Sta.	212-630-6788	
LAB	Albany	518-465-0746	
Pelham Bay	Penn Sta.	212-630-7193	
Q	Penn Sta.	212-630-7763	
R	Penn Sta.	212-630-7349	
West End Yardmaster	SSYD	212-630-7762	
East End Yardmaster	SSYD	212-630-7763	
Engine House	SSYD	212-630-7203	
WT, PW, NYP & PH LINES			
Chief Dspr	Phila.	215-349-2417	...
Asst Chief H	Phila.	215-349-2e 215-349-2227	...
Dspr Section B	Phila.	215-349-2230	054-054
Dspr Section C	Phila.	215-349-2231	035-035
Assistant Chief I	Phila. Phila.	215-349-2251 215-349-2252	...
CETC-1 TD	Phila.	215-349-2263	054-054
CETC-2 TD	Phila.	215-349-2264	
CETC-3 TD	Phila.	215-349-2265	
CETC-3 North TD	Phila.	302-552-4603	
CETC-4 TD	Phila.	215-349-2266	
CETC-5 TD	Phila.	215-349-2233	
CETC-6 TD	Phila.	215-349-2232	054-054 035-035
Overbrook	Phila.	215-349-2335	
Paoli	Phila.	215-349-2336	
Thorn	Lanc. Phila.	717-291-5043 215-349-3237	
Zoo	Phila.	215-349-2340	054-054 084-12
Control Center	Wash	202-906-2301	
Toll Free		800-372-9700	
K Tower	Wash	...	
TD A (Amtrak moves)		202-906-3624	
TD B (Marc Moves)		202-906-3625	
Asst Train Director		202-906-3628	
ADFO (Flags/orders)		202-906-3627	
FAX		202-906-3035	
Yardmaster	Wash	202-906-2328	084-012

4) Power Directors and Load Dispatchers

TABLE 7 - POWER DIRECTORS AND LOAD DISPATCHERS TELEPHONE NUMBERS

Position	Exchange	Commercial
Power Director – Zone 10 East South Station MP 228.7 to Richmond MP 150.1	Boston	617-204-6961
Power Director – Zone 10 West W83 Richmond MP 150.1 to Mill River MP 72.9	Boston	617-204-7714
Power Director – Zone 10 Emergency Only	Boston	617-345-7413
Power Director – Metro North Mill River MP 72.9 to CP 216 MP 18.7	G.C. T.	212-340-2100
Power Director - Zone 1 CP 216 MP 18.7 to Bergen MP 3.2	Penn Sta.	212-630-7684 215-630-7685
Power Director – Zone 1 Emergency Only	Penn Sta.	212-630-7911

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Power Director - Zone 2 & 3 Bergen MP 3.2 to Holmes MP 76	Penn Sta.	212-630-7680 212-6307681
Power Director - Zone 4 Holmes MP 76 to Paoli to Glenolden MP 8.1	Wilmington	302-552-4640 302-552-4641
Power Director - Zone 5 Glenolden MP 8.1 to Gunpow MP 79.5	Wilmington	302-552-4650 302-552-4651
Power Director - Zone 6 Gunpow MP 79.5 to Washington MP 136	Wilmington	302-552-4660 302-552-4661
Power Director - Zones 8 = Paoli to Harrisburg MP 104	Wilmington	302-552-4680 302-552-4681
Load Dispatcher	Philadelphia	215-349-2020 215-349-4046

While Mileposts in the above table are accurate, location names represent the nearest railroad characteristic.

5) Foreign Utility Emergency Contact Information

TABLE 8 - FOREIGN UTILITY EMERGENCY TELEPHONE NUMBERS

Division	Foreign Utility		Emergency Numbers
New England	Ever Source		844-885-1010
	Rhode Island Energy		401-955-7501
	National Grid		1-800-423-6029
New York	ConED	Manhattan	212-580-6750
		Bronx	212-580-6791
		Queens	212-580-6748
		New Rochelle	212-580-6754
	PSE&G		1-800-880-7734
	PECO		1-800-253-0201
Mid-Atlantic	Delmarva		302-283-6065
	PEPCO		301-469-5521
	PPL		1-800-342-5775
	BG&E		410-470-7503
	Brookfield		508-251-7744

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

7. Electric Traction Systems Locations, Nominal Voltage and Frequencies

1) Transmission System

TABLE 9 - TRANSMISSION SYSTEM NOMINAL VOLTAGES AND FREQUENCY

Transmission Lines		Number of Circuits	Phase	Nominal Voltage	Frequency
Right of Way	End Points				
Washington to Philadelphia (PW)	Sub 25 Ivy City to Sub 9 Zoo	2	1	138,000 V	25 Hz
	Sub 16 Perryville to Conestoga	4	1		
	Sub 11 Lamokin to SEPTA Lenni	1	1		
	Sub 2S Arsenal to SEPTA Morton	1	1		
-	Safe Harbor to Conestoga	3	1		
-	Conestoga to Sub 71 Royalton	1	1		
Philadelphia to Harrisburg (PH)	Sub 72 Harrisburg to Sub 71 Royalton	2	1		
	Sub 71 Royalton to Sub 69 Landisville	1	1		
	Sub 69 Landisville to Sub 66 Parkesburg	2	1		
	Conestoga to Sub 66 Parkesburg	2	1		
	Sub 66 Parkesburg to Earnest Switching	2	1		
	Sub 64 Frazer to Sub 4 Paoli	2	1		
	Earnest Switching to Sub 9 Zoo	2	1		
New York to Philadelphia (NYP)	Sub 9 Zoo to Sub 30 Frankford	2	1		
	Sub 30 Frankford to Richmond SFC	2	1		
	Richmond SFC to Sub 42 Hacken Sack	4	1		
	Metuchen Step-up to Metuchen Taps	4	1		
	Sub 39 Rahway to NJT South Amboy	4	1		

TABLE 10 - TRANSMISSION SYSTEM UTILITY SUPPLY NOMINAL VOLTAGES AND FREQUENCY

Transmission System Utility Supply	Provider	Number of Circuits	Phase	Nominal Voltage	Frequency
Conestoga Step-Up from Safe Harbor	Brookfield	3	3	138,000 V	25 Hz
Jericho Park SFC	BG&E	2	3	230,000 V	60 Hz
Lamokin Rotary	Brookfield	3	3	132,000 V	60 Hz
Richmond SFC	PECO	2	3	69,000 V	60 Hz
Metuchen SFC	PSE&G	2	3	230,000 V	60 Hz
Metuchen Rotary	PECO/PSE&G	1	3	132,000 V	60 Hz
Sunnyside SFC	ConED	2	3	138,000 V	60 Hz
Sub 46 Van Nest	ConED	2	1	138,000 V	60 Hz
Sub 80 Branford	Ever Source	2	3	115,000 V	60 Hz
Sub 82 New London	Ever Source	1	3	115,000 V	60 Hz
Sub 84 Warwick	Rhode Island Energy	1	3	115,000 V	60 Hz
Sub 86 Sharon	Ever Source	1	3	115,000 V	60 Hz

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2) Overhead Catenary System

TABLE 11 - OVERHEAD CATENARY SYSTEM NOMINAL VOLTAGE AND FREQUENCY

Overhead Catenary System		Type	Contact/Feeder Wire to Rail Voltage	Contact Wire to Autotransformer Feeder	Frequency
Washington to Philadelphia (PW)		Fixed	12,000 V	-	25 Hz
Philadelphia to Harrisburg (PH)		Fixed	12,000 V	-	25 Hz
New York to Philadelphia (NYP)	New York to Midway	Fixed	12,000 V	-	25 Hz
	Midway to CP Clark*	Constant	12,000 V	-	25 Hz
	CP Clark to Zoo*	Fixed	12,000 V	-	25 Hz
New York Terminal (NYT)		Fixed	12,000 V	-	25 Hz
Harold to CP 216 (NYS)	West of Cat. Pole C-70	Fixed	12,000 V	-	25 Hz
	East of Cat. Pole C-66	Fixed	12,500 V	25,000 V	60 Hz
New Haven to Boston (NHB)		Constant	25,000 V	50,000 V	60 Hz

*Construction on-going to extend Constant Catenary from CP Clark to Ham

3) Signal System

TABLE 12 - SIGNAL POWER SYSTEM NOMINAL VOLTAGE AND FREQUENCY

Signal Power System	Location	Nominal Voltage	Frequency
Mid-Atlantic	Washington to SEPTA Walnut SUB	6900 V	100 Hz
	Arsenal Tower to Zoo Tower Basement	440 V	
	SUB 9 Zoo to SUB 4 Paoli	3300 V	
	SUB 4 Paoli to Sub 72 Harrisburg	6900 V	
Mid-Atlantic/New York	30th Street South End 1 Platform to Lane	6900 V	91 2/3 Hz
New York	SUB 40 Waverly – 840 to SUB 42 Hackensack	6900 V	
	SUB 42 Hackensack to SUB 44 Sunnyside	2300 V	
Hellgate	Gate Interlocking to Shell Interlocking	7200 V	100 Hz
New England	New Haven to Boston South Station	480 V	60 Hz

4) Third Rail System

TABLE 13 - THIRD RAIL SYSTEM NOMINAL VOLTAGE

Third Rail DC Voltage	
Amtrak & LIRR	750 V

5) Wayside & Head End Power System

TABLE 14 - WAYSIDE AND HEAD END POWER NOMINAL VOLTAGE AND FREQUENCY

Wayside & HEP Systems	
Voltage	Frequency
480 V	60 Hz

8. Tracks Equipped for Electrical Operation

1) Tracks Equipped for AC Electrical Operation

A. All Amtrak Main Line Tracks are Equipped for AC Electrical Operation, EXCEPT:

TABLE 15 - AMTRAK MAIN LINE TRACKS NOT EQUIPPED FOR AC ELECTRICAL OPERATION

Amtrak Main Line Tracks NOT Equipped for AC Electrical Operation	
PW Line	Track No. 1 Carroll and Landover
HUD Line	Track No. 1 north of MP 1.1 and Track 2 north of MP 1, Post Rd. Branch
NHB Line	Track No. 3 between Pine & Orchard
	Track No. 3 between Stony and end-of-track
	Track No. 4 between Davisville & Malcolm
	Track No. 3 between Packard & Atwells
	Track No. 7 between Atwells and Orms
	Track No. 3 between Thatcher & Holden
	Tracks No. 1 & No. 13 Boston South Station
MRS Line	All Tracks
PH Line	State Int, Track No. 8 from 538 feet west of the 8W Signal to end of track, electric lock switch at MP 39.27 to Caln Interlocking (Coatesville Station Bypass).

B. Other Equipped Tracks:

TABLE 16 - OTHER TRACKS EQUIPPED FOR AC ELECTRICAL OPERATION

Other Tracks Equipped for AC Electrical Operation	
DB Line	No. 1 Track and No. 2 Track and associated switches and crossovers from Tower 1 to and including the diamond at South Bay
MM Line	Track No. 14 to and including Cabot

Various non-main tracks on the above Lines are also equipped for AC electrical operation.

C. Power Directors Assigned Territories

TABLE 17 – POWER DIRECTORS ASSIGNED TERRITORIES

Power Directors Assigned Territories	
Power Director at CETC, South Station, Boston, MA	All electrified tracks between New Haven & Boston
Metro North Power Supervisor at Madison Avenue, New York, NY	All electrified tracks east of dead sections catenary poles 204H to 206H (NYS Line)
Power Director at CETC, New York, NY	All electrified tracks between dead sections catenary poles 204H to 206H (NYS Line) and MP 76 (NYP Line)
Power Director at CETC, in CNOC, Wilmington, DE	All electrified tracks between MP 76 and Zoo (NYP Line) and between Penn and MP 21 (PH Line)
	All electrified tracks between Zoo and Washington Terminal
	All electrified tracks between MP 21 and Harrisburg (Philadelphia to Harrisburg)

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

2) Tracks Equipped for DC Electrical Operation

A. Amtrak Main Line Tracks Equipped for DC Electrical Operation:

TABLE 18 - AMTRAK MAIN LINE TRACKS EQUIPPED FOR DC ELECTRICAL OPERATION

Amtrak Main Line Tracks Equipped for DC Electrical Operation	
NYT Line	All Main Tracks on NYT Line between Harold and C-JO.
NYT Line Running Tracks	Sub tracks 1, 2 and 3 to a point 1000 feet east of connection with No. 4 track (Line 4) and No. 2 track (Line 2) at F.
	Loop tracks No. 1 & 2 to a point 1000 feet east of connection with No. 1 track (Line 1) and No. 3 track (Line 3) at F.
Other Tracks on NYT Line	Loop A; between Loop & R. Note: Third rail shoes are required to be in the down position until equipment is clear of the R Switching Center Loop A westward home signal.
	Loop 1; between Loop & T. Note: Third rail shoes are required to be in the down position until equipment is clear of T Interlocking.
	Third rail is installed over route extending between Sub 1 Trk F-Q; Sub 1 and 2 Crossover (Q 67 SW); Q Switching Center 1 Lead and North Runner Q-R to a point 1000 ft. east of hand-operated crossover leading to LIRR Midday Yard.
	Loop 1; between F & Loop interlocking, extending east into Loop interlocking to a point 15 feet west of the facing point turnout for eastward movement to Loop A (19 Sw).
	Loop 2; between F & Loop interlocking, extending east into Loop Interlocking to a point 15 feet west of the facing point switch (21A Sw.) for eastward movement to Loop 1.
	712 feet of new track within Harold Interlocking limits, designated as WX Track, located 148 feet west of MP 3.7 (Former Harold Interlocking Station).
	543 feet of new track within Harold Interlocking limits, designated as Long Island Freight Track, located 553 feet east of MP 3.7 (Former Harold Interlocking Station).
	982 feet of new track within Harold Interlocking limits, designated as Track A, located 1687 feet east of MP 3.7 (Former Harold Interlocking Station).
	81 feet of new track within Harold Interlocking limits, designated as Track B/C, located 742 feet east of MP 3.7 (Former Harold Interlocking Station).
	1292 feet of new track within Harold Interlocking limits, designated as Track D, located 2233 feet east of MP 3.7 (Former Harold Interlocking Station).
	705 feet of new track within Harold Interlocking limits, designated as Southeast Lay Up Track, located 3278 feet east of MP 3.7 (Former Harold Interlocking Station).
	3119 feet of new track within Harold Interlocking limits, designated as Westbound Bypass Track, located 3198 feet east of MP 3.7 (Former Harold Interlocking Station).
New York Penn Station	A Yard Track 5A
	D Yard Track 6
	Station tracks 5 through 21 inclusive
	No. 1x
	No. 3x through 6x tracks inclusive.
	Tracks 8C, 9C & 10C between KN and Yard C.
NYP Line	Tracks 2 & 3 between A and the west portals of the North River Tunnels.
HUD Line	No. 2 track between A and a point 235 feet north of MP 1.
	No. 1 track between beginning of track at Empire and a point 235 feet north of MP 1.

B. On HUD Line, DC operation RESTRICTED north of MP 5: Trains must not operate north of MP 5 with third rail shoes in lowered position, unless otherwise instructed.

C. All Amtrak DC electrified tracks are in charge of the Power Director at CETC, New York, NY.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

9. Minimum Approach Distances

1) AC Minimum Approach Distances

TABLE 19 - AC MINIMUM APPROACH DISTANCE

Condition	AC Systems or Nominal AC Voltage of Wires, Cables, Circuits, and/or Apparatuses	Minimum Approach Distance		Power Protection
		Class "D"	Class "C", "B", "A" OR Class "D" under direction of a Class "A" Employee	
Equipment operating in the vicinity of:	Unidentified / Transmission or greater than 30,000 V	15 feet	15 feet	Clearance / Approved Barrier
	Catenary / Signal or below 30,000 V	15 feet	3 feet	
Personnel working in the vicinity of:	Unidentified / Transmission or greater than 30,000 V	15 feet	8 feet	Clearance / Approved Barrier / Catenary Isolation / Work Permit
	Catenary / Signal or Between 481 and 30,000 V	8 feet	3 feet	
	Secondary Circuits between 150 and 480 V	6 inches	6 inches	Work Permit / LOTO / Insulated Rubber Gloves and Leather Gauntlets
	Secondary Circuits / Control Circuits less than 150 V	Avoid Contact	Avoid Contact	

2) DC Minimum Approach Distances

TABLE 20 - DC MINIMUM APPROACH DISTANCE

Condition	DC Systems or Nominal DC Voltage of Wires, Cables, Circuits, and/or Apparatuses	Minimum Approach Distance	Power Protection
Personnel working in the vicinity of:	Third Rail or Greater than 150 V	4 feet	Third Rail DC Power Permit / Approved Barrier/ Insulated Rubber Blankets / Insulated Rubber Gloves and Leather Gauntlets
Personnel walking over or on outside edge of Third Rail		6 inches	
Personnel working in the vicinity of:	Control House Battery Systems / DC Control Circuits or Less than 150 V	Avoid Contact	Work Permit / LOTO / Insulated Rubber Gloves and Leather Gauntlets

10. Phase Break and Dead Section Locations

1) Dead Section Locations

TABLE 21 - DEAD SECTION LOCATIONS

Line	Location Relative to Nearest Station	Specific Location of Each Dead Section		
		Track	West End	East End
New Haven to Boston (NHB)	West of Mill River ¹	2 & 4	MP 73.21	MP 73.30
		1 & 6	MP 73.17	MP 73.26
	West of Branford ¹	2	MP 78.91	MP 78.98
		1	MP 78.93	MP 79.01
	West of Brook	2	MP 103.03	MP 103.13
		1	MP 103.06	MP 103.16
	West end Groton ²	1 & 2	MP 123.62	MP 123.66
	East of High St.	1 & 2	MP 150.10	MP 150.21
	West of Cranston	1 & 2	MP 176.88	MP 176.99
	East of Holden	1 & 2	MP 198.92	MP 199.01
Harold to CP 216 (NYS)	East of Gate Int	1 & 2	MP 18.31	MP 18.25
		1 & 2	MP 5.35	MP 5.23

Note 1: This dead section is also a catenary voltage change location from 12.5KV to 25KV.

Note 2: Dead Section Stop Signs in service for eastbound electric trains on Tracks 1 and 2 at MP 123.41.

2) Phase Break Locations

TABLE 22 - PHASE BREAK LOCATIONS

Line	Tracks	Catenary or Signal Bridge	Distance of Phase Break
Philadelphia to Washington (PW)	1 & 2	Catenary Bridge 58.68	200 feet Northward & Southward
	3 & 4		
Philadelphia to Harrisburg (PH)	1 & 2	Catenary Bridge 33.78	360 feet Eastward & Westward
	3 & 4	Catenary Bridge 33.71	

3) Position Light Phase Break Indicator Location

TABLE 23 - POSITION LIGHT PHASE BREAK INDICATOR LOCATION

In service on track	Governs track(s)	For direction	Location of Indicator	Distance from Phase Break
PW Line: Perry				
1	1	North & South	Northward trains:	1425 feet
2	2		Signal Bridge 590	1425 feet
3	3		Southward trains:	1425 feet
4	4		Coudon's Rd. OHB, MP 58.34	1425 feet
PH Line: Thorndale Substation				
1	1 & 2	East	Eastward trains: Catenary Bridge 34.15	1925 feet
3	3 & 4	East		1925 feet
1	1 & 2	West	Westward trains: Catenary Bridge 33.39	1900 feet
4	3 & 4	West		1900 feet

Position Light Phase Break Indicators are in advance of the Position Light Phase Break Indicator (PB) Sign.

11. Glossary

Abbreviations included in parentheses and universally recognized abbreviations/symbols for measurements are authorized for use in Plate Orders, Clearances, Work Permits, Third Rail DC Power Permits, ET Logbooks and ET Tags.

138 kV Bus Section (Roof Bus)

That portion of the 138 kV transmission system located in the substation between the air break switches, tie switches, and high side switches to which the power transformers may connect.

AC Hold

A term to describe the restriction on the movement of AC Electric Equipment within a specified area. Generally issued by the Amtrak Power Director to a Train Dispatcher.

Air Break Switch (ABSW)

Gang operated open-air horn-gap transmission disconnect switches with corresponding ground switches.

Already Open (A/O)

Signifies electrical device is already in the open position.

Alternating Current (AC)

The current flows in one direction then reverses and flows in the opposite direction.

AMT-2 Qualified

A status achieved when the person has satisfactorily completed all classroom or on-the-job training requirements, passed all required examinations, able to recognize electrical hazards, identify the nominal voltage of electric traction systems circuits/equipment and is expected to perform all required duties related to assigned position and territory safely, efficiently and in compliance with all applicable rules and instructions per assigned position, further classified as:

- **Class "A"**
Personnel who perform work on or near Amtrak's Electric Traction System maintaining Minimum Approach Distances AND are qualified to use electrical devices, techniques, personal protective equipment, insulating and shielding materials, tools, etc. to control/remove electrical hazards providing Protection for themselves or any other personnel for the purpose of constructing, maintaining, and working on or near the Electric Traction System.
- **Class "B"**
Personnel who perform work on or near Amtrak's Electric Traction System maintaining Minimum Approach Distances AND are qualified to use catenary isolation devices or sectionalizing switches, personal protective equipment, and insulated tools for working on electrical equipment in designated mechanical facilities to provide Protection for themselves.
- **Class "C"**
Personnel who perform work on or near Amtrak's Electric Traction System maintaining Minimum Approach Distances.
- **Class "D"**
Any personnel authorized to work on Amtrak property and do not have the classification of Class "A", Class "B", or Class "C."

Amtrak Electrified Track

A track designated by Amtrak timetable, special instructions, general order, or bulletin upon which AC and/or DC Electric Equipment movements are authorized by operating rules.

And (&)**Arc-Flash**

A luminous and potentially destructive flash or flame in or about the wires, third rail, or electric apparatus caused by fault is the flow of current through the air between phase conductors or phase conductors and neutral or ground.

Arc Rated (AR)

The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

Arc Rated Category

Classification of Arc Rated PPE, with each category including the minimum Arc Rating value for the required PPE. This value represents the amount of incident energy (in Cal/cm²) on a material or a multilayered system of materials that results in a 50% probability to cause the onset of a second-degree skin burn injury.

- Cat 1 – 4 Cal/cm²
- Cat 2 – 8 Cal/cm²
- Cat 3 – 25 Cal/cm²
- Cat 4 – 40 Cal/cm²

Assistant Division Engineer (ADE)**Authorized**

Broad term indicating that a person is approved or assigned by Amtrak to perform a specific type of duty or duties or to be at a specific location or locations at the jobsite. Such as:

- Work on or about an electric circuit, apparatus, or equipment.
- Enter substations, frequency converter stations, or electrical enclosures.
- Perform duties at a location where the person will be exposed to a fall hazard

Auto Drop

A feature on some equipment that will automatically lower the pantograph when the air system to the pantograph has been compromised or a Broken Pantograph Alarm has been activated.

Auto-Reclose

A feature of the overhead catenary electrification in the 60 Hz system and signal power system that will attempt to automatically close a circuit breaker one time upon fault.

Autotransformer (AT)

A power transformer with only one winding that is used to boost voltage.

Autotransformer Feeder

A feeder adjacent to the catenary that utilizes autotransformers to maintain the overhead catenary system voltage at selected points. Synonyms: Negative feeder, Auxiliary feeder, feeder.

Auxiliary Wire

A solid wire in the Overhead Catenary System suspended from the messenger wire by hangers to which the contact wire is attached by clips. Depending on location, this wire may not be in use and contact wire may be attached directly to messenger by hangers.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Balance Weight Assembly

A system of cables, pulleys and weights at the end of a tensioning section used to maintain constant in the overhead catenary system.

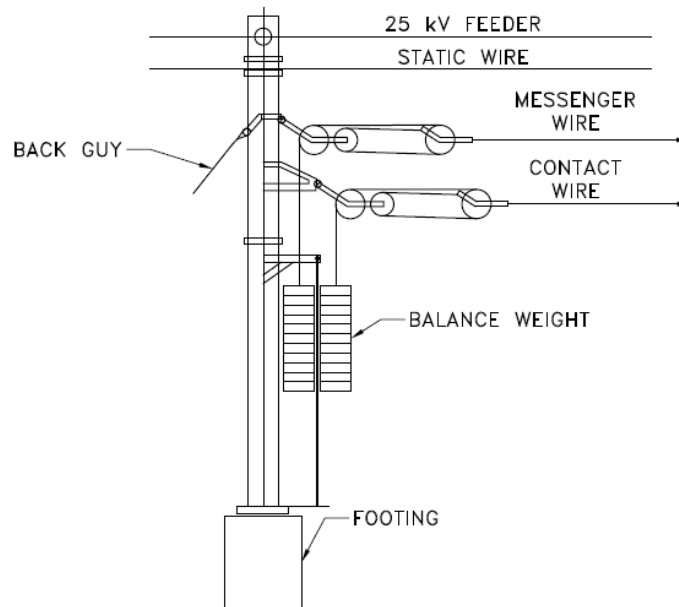


FIGURE 22 - TYPICAL BALANCE WEIGHT ASSEMBLY AT DEAD ENDS

Bell Temperature Alarm (BTA)

An alarm received when transformer windings heat up and reach a predetermined temperature value. It is necessary that the transformer be taken offline in order to minimize damage to equipment caused by overheating.

Blocking Device

- (1) A method of control that prohibits the operation of a switch or signal, restricts access to a section of track or is used to protect conditions specific to operating rule(s).
- (2) A method of control that prohibits the operation of an energy isolating-device, preventing the inadvertent energizing of equipment for the purpose of protecting personnel.

Blocking Device Removal Code (BDRC)**Blocking Point**

A disconnecting means to isolate a circuit or apparatus from an energy source, e.g., manual or motor operated switches, section breaks, and dead ends.

Body Span

A de-energized horizontal stranded cable between two poles or other stationary structures used in a cross-catenary structure that supports the Overhead Catenary System by transmitting the horizontal stress between the two.

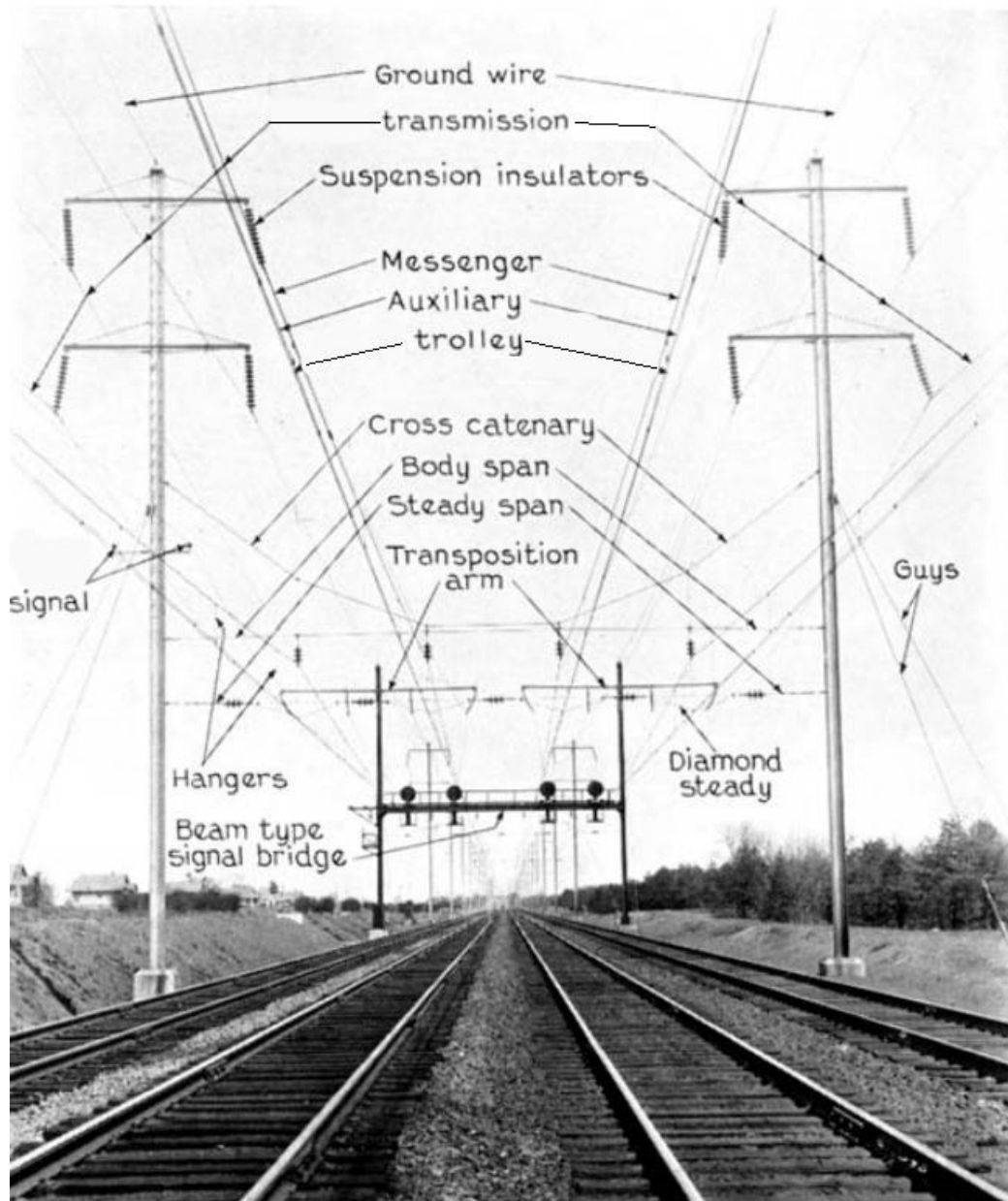


FIGURE 23 – BODY SPAN

Bonding

The method of mechanically interconnecting two or more conductive parts to maintain a common or equal electrical potential.

Bridge (Br)

Indicates a Bridge

Bridges & Buildings (B&B)

Broken Pantograph Alarm (BPA)

An alarm on some equipment generated when the pantograph, carbon strip and/or its air system has been compromised.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Buffer Zone

Arrangement in Overhead Catenary System allowing sectionalizing of circuits within a Mechanical Facility.
Example schematic:

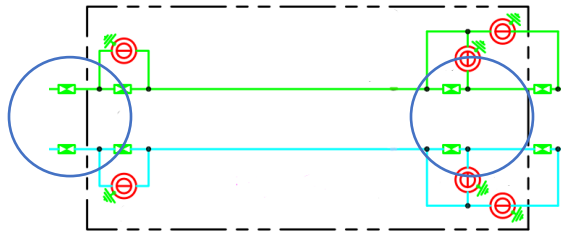


FIGURE 24 - BUFFER ZONE SCHEMATIC

Bus (B)

A conductor or a group of conductors used for collecting electric power from the incoming feed and distributes them to the outgoing feed.

Bus Breaker (BB)

A circuit breaker that is positioned as a bus tie connecting two individual substation bus configurations.

Bus Tie (BT)

A device that is positioned to connect two individual substation bus configurations.

Catenary Isolation System

A system used to de-energize and ground the catenary at terminals or engine service track area, made up of catenary disconnect switches and catenary ground switches.

Catenary Maintenance Vehicle (Cat Car)

A track car used to maintain and inspect Overhead Catenary System. Equipment Designation MTW-100.



FIGURE 25 - CATENARY MAINTENANCE VEHICLE

Catenary (Cat)

Broad term used to indicate a two wire (Messenger & Contact) or a three wire (Messenger, Auxiliary & Contact) arrangement within Overhead Catenary System.

Catenary Span

A de-energized stranded cable used in a cross-catenary structure that supports and holds wires of Overhead Catenary System in place.

Central Electrification & Traffic Control (CETC)

Centralized control system used for movement of trains and control of the electric traction system.

Checkmark (✓)

Circuit

The complete path over which electric current is transmitted from and returned to its source.

Circuit Breaker (CB)

A device which normally operates automatically under conditions of overload, short circuit, or by remote control to energize or de-energize transmission lines, signal power lines, catenary, third rail, or primary circuits on electric equipment so equipped.

- **Air Circuit Breaker (ACB)**
Utilizes compressed air as arc quenching medium to exterminate the arc produced when the contacts are separated.
- **Oil Circuit Breaker (OCB)**
The arc is drawn in oil to dissipate the heat and extinguish the arc; the intense heat of the arc decomposes the oil, generating a gas whose high pressure produces a flow of fresh fluid through the arc that furnishes the necessary insulation to prevent a restrike of the arc.
- **Vacuum Circuit Breaker (VCB)**
Utilizes a vacuum to extinguish arcing when the circuit breaker is opened and to act as a dielectric to insulate the contacts after the arc is interrupted.
- **Sulfur Hexafluoride Circuit Breaker (SF6 CB)**
SF6 Gas primary use is in the electrical industry as a gaseous dielectric medium for various voltage circuit breakers, switchgear, and other electrical equipment, often replacing oil filled circuit breakers that can contain harmful PCBs.

Class “A” Qualified and Authorized List

Lists noting employees who are qualified AMT-2 Class “A” and authorized in a defined territory to receive power based on craft. See ET SharePoint Site.

Clearance

The procedure to de-energize, test de-energize and apply grounds to circuit(s) or apparatus(es) in Amtrak’s electric traction system.

Clearance Forms

Documents that record steps taken between the Power Director (NEC 84 & NEC 84.E) and Class “A” employee (NEC 260) when it is determined that power must be removed, and temporary protective grounds are to be applied to circuits or apparatus in electric traction system.

Close & Trip (C&T)

Closed (CL)

Used to designate that an electrical device is closed.

Collector Head Assembly

The part of the pantograph made up of a set of carbon strips and end horns connected to the main frame of the pantograph assembly by means of an apex.

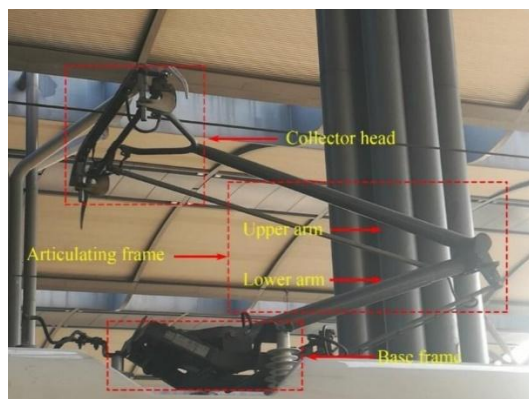


FIGURE 26 - COLLECTOR HEAD ASSEMBLY

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Common Roadway Abbreviations (Ave, Blvd, Ln, Rd, Rt, St, etc.)**Communications & Signals (C&S)****Constant Tension**

A system of suspended conductors fixed at one end and provided with a tensioning assembly on the other end to maintain constant tension and system height on wire during ambient temperature changes.

Constant Tension Support Structure

Supporting structures used in constant tension systems. This typically refers to cantilever structures but also may refer to bridges.

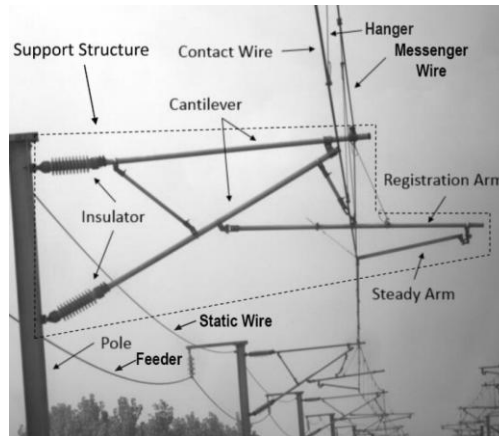


FIGURE 27 - CONSTANT TENSION SUPPORT STRUCTURE

NOTE

The cantilevers and arms are bonded to the catenary and thus at the same operating voltage.

Contact/Trolley Wire

The wire in the overhead catenary system from which the pantograph carbon strip contacts and collects current.

Contact/Trolley Height

The distance from the bottom of contact/trolley wire to the top of the rail.

Control Board

A switch panel used for the operation and supervision of Electric Traction equipment/apparatus.

Control Houses and Huts

Broad term to indicate enclosures used to hold devices (Remote Terminal Units, Battery, Battery Charger, Relays) for control applications. Synonyms: Substation Control House, Battery House, Central Instrument Hut (CIH), Signal hut, Wayside Power Cubicle (WPC).

Current

The rate of flow of electricity through a conductor expressed in Amps.

Current Transformer (CT)

A type of instrument transformer that generates a low AC current in its secondary winding that is proportional to that flowing in its primary winding according to its turn ratio. The secondary current is within a range that can be used by relays, meters, or control devices for protection and control functions.

DC Hold

A term used to describe the restriction on the movement of DC Electric Equipment within a specified area. Generally issued by the Amtrak Power Director to a Train Dispatcher.

Dead End (DE)

Location in which wire is terminated to a fixed point.

Dead Rail Indication (DRI)

Dead Section (DS)

A location in the Overhead Catenary System where section insulators are arranged to provide for an isolated or dead section between different sources of power. Adjoining circuits of a dead section may or may not be of the same voltage, frequency, and/or phase. These locations are also commonly referred to as Phase Breaks, although defined differently.

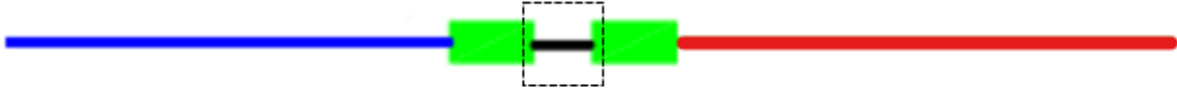


FIGURE 28 - DEAD SECTION SCHEMATIC

Direct Current (DC)

The current flow is always in the same direction.

Disconnect Switch (Disc Sw)

A mechanical switching device, either motor or manual operated, used for isolating a circuit or apparatus from a source of electrical power. Commonly referred to as just a switch.

Dispatcher (Dspr)

The railroad employee assigned to control and issue orders governing the movement of trains on a specific segment of railroad track in accordance with the operating rules of the railroad that apply to that segment of track. Commonly referred to as Train Dispatcher to distinguish from Load Dispatcher.

Do Not Operate Tag - Red Tag (NEC 105)

A safety tag defining operating restrictions to an electrical apparatus.

Do Not Operate Tag - Plate Tag (NEC 106)

A safety tag defining operating restrictions to electrical equipment, switch or apparatus for Plate Orders.

Dual Mode Equipment

Able to be operate as either diesel or an electric engine via batteries, pantograph, or third rail shoe.

Dual Tone Modulated Frequency (DTMF) Radio Controlled Track Switches

A radio activated dual control power switch system specifically for remotely controlling switches in yards or dark territory to improve train operation safety and efficiency.

Electric Equipment

Locomotives and multiple unit cars operated by power received from the overhead catenary system or third rail.

Electric Power

The rate at which electric energy is transferred by an electric circuit expressed in Watts or Volt-Amps.

Electric Traction (ET)

Electric Traction System

The combination of transmission, frequency converter stations, substations, overhead catenary, third rail, signal power and rail return systems used exclusively for operation of electric equipment or installations used exclusively for signaling and communication purposes.

Electrical Disconnect (ELDISC)

AMT - 2 ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Electrified Territory

The portion of the railroad equipped for electric train operation.



FIGURE 29 - AMTRAK AC ELECTRIFIED TERRITORY

Electronic Technician (E-Tech)

Emergency Condition

Any condition which results in the loss of overhead catenary or third rail power for extended periods, derailments, smoke or fire condition which has the potential of causing injury/illness to passengers and/or employees.

Employee in Charge (EIC)

An employee responsible for a work group under the overarching authority of the Roadway Worker in Charge (RWIC). EICs must be qualified on the physical characteristics and operating rules of the territory when engaged in work performed on or near tracks under the protection or authority of an RWIC. (This qualification is not mandatory for EICs who are not actively involved in On-Track railroad work and do not meet the definition of "Roadway Worker.")

End Approach

The gradual slope or incline of the third rail at the beginning and end of each third rail section. This allows for the smooth transition of the third rail shoe.



FIGURE 30 - END APPROACH

ENERGIZED or DE-ENERGIZED - LIVE (DANGEROUS TO LIFE)

An electrical circuits/apparatus that is: (1) connected to a power source OR (2) removed from power source but not yet afforded Protection being tested de-energized and equipped with a temporary protective ground and/or warning device.

Energy-Isolating Device

A mechanical device that physically prevents the transmission or release of energy. Examples of energy-isolating devices include manually operated electrical circuit breakers, disconnect switches, manually operated switches that disconnect the conductors of a circuit from all ungrounded supply conductors, line valves, blocks, and any similar device used to block or isolate energy.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Engineering Practice (EP)

Establishes a system of uniform notice and supplemental instruction (Practices) to Amtrak Operating Instructions (Rules) for the Engineering Crafts and Capital Delivery Department.

Enhanced Employee Protection System (EEPS) for Power Protection

An electronic means of enhancing Clearance/Third Rail DC Power Permit Protection to Class "A" Employees and personnel working under Clearance/Third Rail DC Power Permit.

Estimated Time of Arrival (ETA)

ET Logbook

System in which Load Dispatchers and Power Director documents routine actions (i.e., mark-offs, equipment being removed or returned to service, etc.) as well as unusual actions and events (i.e., tripping's, AMT-2 rules violations, equipment, computer, or communication failure, etc.) the actions that were taken and who was notified.

ET Trainee

Electric Traction employees that are working towards craft specific qualifications.

Fail To Operate (FTO)

Fault

A physical condition that causes electrical apparatus/equipment to fail to perform as designed.

Feeder (F)

Broad term used to designate wire that feeds electricity from one location to various parts of the electrical system.

Field Equipment Operational Test (FEOT)

A full remote operational test from the Power Director/Load Dispatcher controls field equipment, verifying controls and status of the equipment.

Fixed Termination

A system of suspended conductors fixed between dead-end to dead-end. The tensions and system height in each wire will change with the ambient temperature.

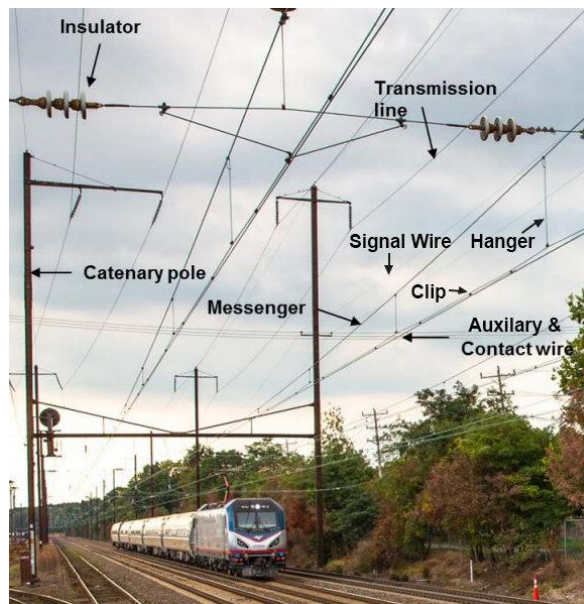


FIGURE 31 - FIXED TERMINATION

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Fixed Tension Support Structures

Structures used to support Overhead Catenary System in fixed tension territory. This includes but is not limited to:

- **Cross-Catenary Structure**

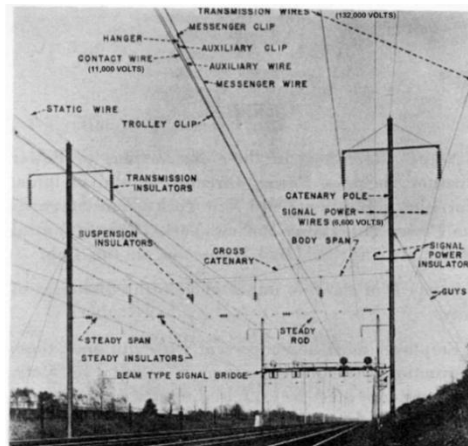
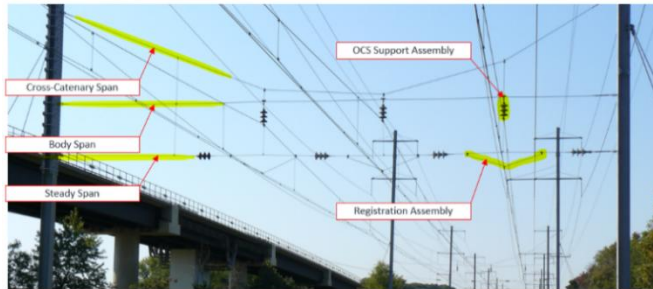


FIGURE 32 - CROSS-CATENARY STRUCTURE

- **K-Beam**



FIGURE 33 - K-BEAM

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- **Overhead Bridge**



FIGURE 34 - OVERHEAD BRIDGE

- **Signal Bridge**



FIGURE 35 - SIGNAL BRIDGE

- **Cantilever Structure**



FIGURE 36 - CANTILEVER STRUCTURE

Floating a Substation

Procedure to isolate a substation from Electric Traction System.

Foreman (Frm)

Form D

A Form D is issued by the Train Dispatcher to restrict or authorize movement and/or convey instructions that are not covered in the Operating rules.

Frequency

The number of current cycles per second, expressed as Hertz.

Frequency Converter Station

A location where electric power is received from a local utility at 60Hz and is converted to 25Hz for distribution to Amtrak's Electric Traction System.

Fuse

A single-use overcurrent protective device designed to open and isolate a circuit when exposed to current above and beyond its normal operating condition.

Gang Foreman (GF)**Gantry**

A type of structure used to support electrical equipment in a substation. Typically guide feeders from the last tower near the substation to the electrical equipment in the substation.

Gas Insulated Switchgear (GIS)

High voltage equipment, utilizing pressurized gas (i.e., SF₆) as the primary insulating medium. Compartments within a gas-insulated assembly, containing various functional modules (circuit-breakers, switches, busbars), may be physically isolated from each other, such that each can be regarded as a separate gas enclosure.

Ground (G or GND)

A conducting connection, whether intentional or accidental, by which an electrical circuit or object is connected to the common return of an electrical system or conducting mass of the earth resulting in the circuit or object being grounded.

Grounding Switch

A device that is closed to connect wires or electric apparatus mechanically to ground.

Hanger

Supporting rods that connect the messenger wire to the auxiliary, contact, or steady-span wire.

Head End Power (HEP)

The electric power distribution system on a train used for heating, lighting, electrical and other non-traction, or non-motive power uses.

High Side Switch (H, HS or HSS)

A motor operated disconnect switch used to isolate or connect the primary side of a transformer.

High-Speed Trainsets (HST)**Home Signal**

A fixed signal governing entrance to an interlocking or controlled point.

Hucking

The process of connecting third rail at its joints, end approaches and/or attaching high voltage cable to third rail, using a hydraulic gun. Bolts, washers, collars, and splice bars are used to secure these joints upon pressure of the hydraulic gun.



FIGURE 37 - HUCKING

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Impedance Bond

Devices that separate signal track circuits from traction return circuits while providing continuity for traction return current around insulated block joints. Typically arranged in pairs and at strategic locations bonded across tracks, to station and other structures, and drain directly back to substations. See Standard Plan SP814 and EP 5100 for distinct types and arrangements.

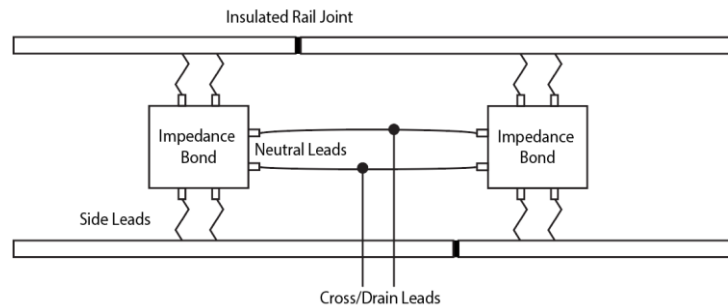


FIGURE 38 - STANDARD IMPEDANCE BOND ARRANGEMENT

Inspection

An examination of equipment or system to assess conformance to a particular standard.

Inspected and Approved Barrier Tag – Green Tag (NEC 101)

Tag affixed to barriers indicating they have been inspected and approved to maintain electrical clearances to energized part.

Insulated Rail Joint (IJ)

A joint in the rail in which electrical insulation is installed between adjoining rails.

Insulated Rubber Equipment

Electrical protective equipment includes rubber insulating blankets, tools, matting, covers, line hose, gloves, and sleeves.

Insulated Tool

Tools used around energized circuits, designed with insulated handles for protection against electric shock.

Insulator

A material, such as wood, polymer, or porcelain, of such low conductivity that the flow of current through it is negligible.

Interlocking (Int)

An interconnection of signals and signal appliances such that their movements must succeed each other in a predetermined sequence, assuring that signals cannot be displayed simultaneously on conflicting routes.

Job Briefing

A meeting conducted prior to starting work, or as needed when conditions change, with all personnel involved in related work task(s) to discuss all aspects of the work to be performed and any safety related concerns.

Job Safety Analysis (JSA)

Used to identify Potentially Hazardous Conditions or Unsafe Practices & determine Safe Work Practices and Preventive Measures. The JSA process is a system-wide tool that can be useful with any group or craft to manage risk. JSAs should be reviewed frequently during briefings, with employees new to the task and if unsure what mitigations are necessary.

Jumper

A temporary or permanent electrical connection for the purpose of bonding.

Junction (JCT)

Lightning Arrester (LA)

A device component used on electric power systems to protect electrical apparatus from damaging effects of lightning. Synonyms: Surge arrester.

Limits of a Clearance / Third Rail DC Power Permit

The blocking points established by the switching instructions to de-energize an area, defined by the body of the Clearance / Third Rail DC Power Permit.

Limits of Protection / Work Area

The area established by the Class "A" Employee where work may be performed.

Limits of Work Permit

The isolation points established by switching and special instructions to work in an area, defined by the body of the Work Permit.

Line (L)

Designates a wire that typically feeds electricity from Trolley Switch within substation to a Line Switch along the right of way, that eventually feeds the Overhead Catenary System.

LIRR Third Rail DC Log Form (NEC 3499)

The document that records steps taken between LIRR RWIC and Third Rail Class "A" Employee when Amtrak roadway workers require protection in proximity to energized third rail owned by the Long Island Railroad.

Live-Line Tool

A type of insulated tool used to maintain Minimum Approach Distance to energized circuit(s)/apparatus. Synonym: tic-stick, hot line, hot-stick, ground-stick, pantograph-pole, or switch-pole.

Load

An electrical component or portion of a circuit that consumes electric power, such as electrical appliances.

Load Dispatcher (LD)

The employee who monitors and regulates electric power demands for the 25 Hz electrification system.

Load Dispatchers Permit

Issued electronically by the Load Dispatcher to the Power Director, granting them permission to disconnect and isolate primary circuits and apparatus under the Load Dispatcher's direction.

Local Control

- (1) When used in relation to Roadway Worker Protection, C&S employees may request permission to take local control of an interlocking to assist the Dispatcher when remote control is lost, or to expedite switch, signal or track circuit testing.
- (2) When used in relation to Electric Traction Activities, ET employees may request permission to take local control of an electrical component(s) to provide Protection OR assist the Load Dispatcher or Power Director when remote control is lost, or to expedite electrical testing.

Location (LOC)

Lock or Locked (L)

Used to indicate that an approved securing device has been applied.

Lockout-Tagout (LOTO)

Protection procedure of personnel, preventing others from turning on or operating equipment by locking out all energy sources, placing tag to warn others and identify responsible person or party, and attempting to test equipment to ensure it is locked out.

Low Side Breaker (LB)

A circuit breaker that protects the secondary side of the transformer from fault currents and overloads by opening when conditions reach a pre-determined value.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Main Circuit Breaker (MCB)

A circuit breaker located on electric equipment that interrupts the flow of power from the pantograph to the electrical locomotives main power transformer.

Maintenance of Equipment (MofE)**Maintenance Of Way (MW)****Manually Operated Disconnect Switch**

A hand-operated disconnect switch.

Mechanical Facility

A Locomotive Servicing or Car Shop Repair Track area, which is one or more tracks, within an area in which the testing, servicing, repair, inspection, or rebuilding of locomotives or Railroad Rolling Equipment is under the exclusive control of Mechanical Department employee.

Messenger Wire

A wire attached to supporting structures from which other wires are suspended.

Mile Post (MP)**Miles Per Hour (MPH)****Minimum Approach Distance (MAD)**

The closest distance personnel, equipment, or tools are permitted to approach an ENERGIZED or De-energized - LIVE (DANGEROUS TO LIFE) wire, cable, circuit and/or apparatus.

The specific Minimum Approach Distances can be found per AC/DC Minimum Approach Distance Tables.

Motor Generator Set (M-G)

A device used to convert electrical power. Synonyms: Rotary signal machines, Motor-Alternator.

Motor Mechanism

A normally remotely controlled device under SCADA control, used to operate air break and disconnect switches.

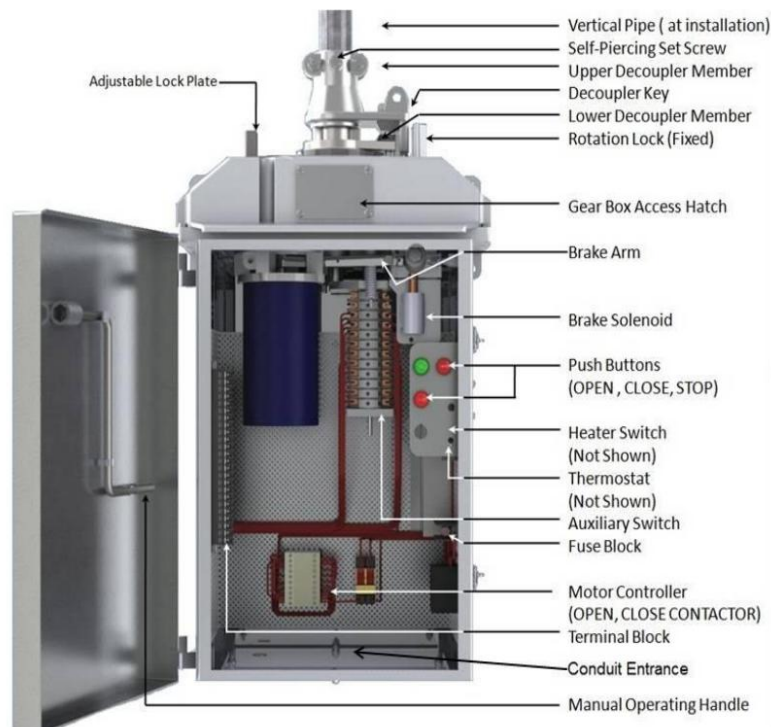


FIGURE 39 - MOTOR MECHANISM

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Motor Operated Electrical Switch

An air break or disconnect switch that is connected and operated by a motor mechanism.

- Motor Operated Air Break (MOAB)
- Motor Operated Disconnect (MOD)

Moveable Catenary Unit (MCU)

An apparatus of the catenary structure located on moveable bridges. Allows the catenary structure to disconnect and moves the catenary to a clear position.

Multiple Units (MU)

Electric equipment used by commuter railroads in local passenger service. Most units have a pantograph on each car. There are some units called married pairs that have one pantograph for two units.

Natural fibers

Any hairlike raw material directly obtainable from an animal, vegetable, or mineral source and convertible into a fabric. Cotton, wool, linen, silk, are some examples of fabrics made from natural fibers.

Neutral Ground Resistor (NGR)

Provide ground fault protection and limit ground fault current through resistance.

NexGen High-Speed Trainsets (NGHST)**No Cause Found (NCF)****No Power Outage (NPO)****No Train in Circuit (NTIC)****Nominal Voltage and Frequency**

The standard voltage and frequency value for the electric traction system.

Non-Controlled Track

A track upon which movements are permitted by rule or by special instructions to move without receiving authorization from the dispatcher.

Nothing Found Wrong (NFW)**Number (No. or #)****Open (O)**

Used to designate that an electrical device is open.

Operating Procedures (OP)

A document that identifies specific steps or tasks that must be taken by Load Dispatcher, Power Director and/or Class "A" Employee to de-energize circuit/apparatus.

Operating Voltage and Frequency

The actual voltage and frequency by which an electrical system operates. It may vary slightly from nominal voltage and frequency due to a range of factors.

Out Of Service (OOS)

Term used to indicate that a tool, piece of equipment, apparatus, etc. is not working properly and/or not able to be used.

Overhead (OH)**Overhead Catenary System (OCS)**

A system of wires suspended on structures supporting overhead wires. Synonym: Overhead Contact System, Catenary.

AMT - 2 ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Pantograph

A device located on top of electric equipment which collects electric power from the contact wire by means of a collector head assembly. Typical simplified arrangement shown:

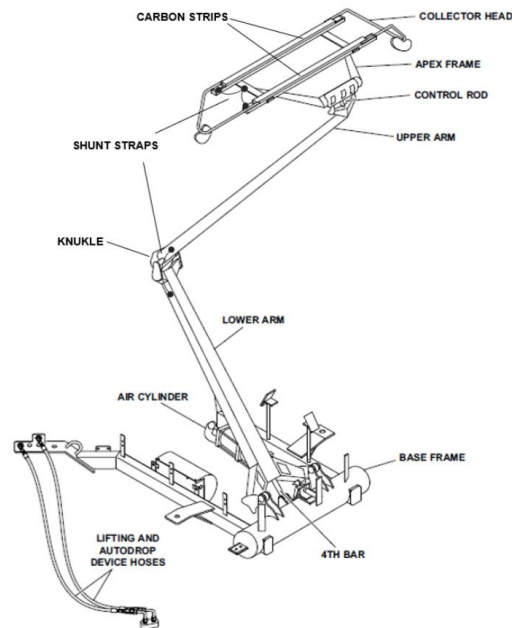


FIGURE 40 - PANTOGRAPH ASSEMBLY

Paralleling Station

A substation located at controlled points along the territory where the catenary and feeder are connected through autotransformers to balance and maintain the catenary voltage. A simplified arrangement shown:

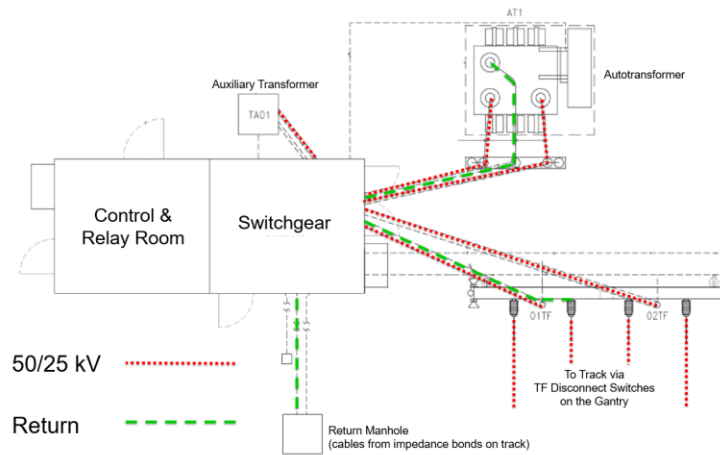


FIGURE 41 – PARALLELING STATION

Person in Charge

Broad term indicating an individual whose designated responsibility is to supervise the work group. This could be a Class “A” Employee, Employee in Charge, Roadway Worker in Charge, Foreman, Mechanical Worker in Charge, etc. depending on the situation.

Personal Protective Ground

Grounds installed in a method that bonds de-energized circuit/apparatus with conductive objects within immediate the worksite, limiting the exposure voltage to a safe value for the purpose of protecting workers.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Phase Break (PB)

A location in the overhead catenary system where section insulators, circuit breakers, and electrical switches are arranged to provide for an isolated or dead section between different sources of power as needed. Under normal operating conditions the phase break and adjoining circuits are of the same voltage and frequency and are in phase. Example schematic:

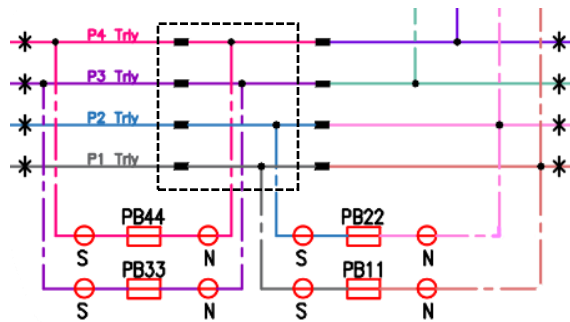
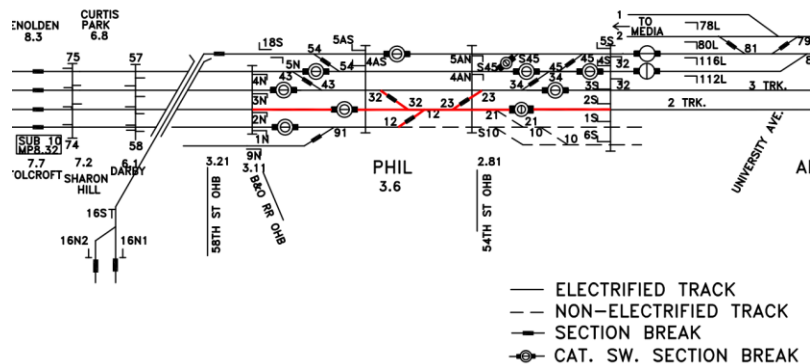


FIGURE 42 - PHASE BREAK SCHEMATIC

Plate

Denoted by a Plate Number contained in a Plate Book, graphically communicates section of electrified track that when a Plate Order is in effect, there are to be no electric equipment moves or consists with third rail shoes / raised pantograph over the affected area. Example Schematic:



NO ELECTRIC MOVEMENTS ON TRACKS SHOWN RED

FIGURE 43 – PLATE SCHEMATIC

NOTE

A Plate does not directly indicate where Catenary above a track is to be de-energized.

Plate Order

The procedure to prevent electric equipment or consists with third rail shoes / raised pantograph from entering a section of track.

Plate Order Form (NRPC 2990)

A document that records steps taken between all involved parties when it is necessary to complete a Plate Order.

Potential Gradient

The change of voltage with respect to distance.

Potential Transformer (PT)

A type of instrument transformer used to generate a lower voltage for relays or meters to use for protection and control.

Power Director (PD)

A person in charge of power distribution. They manage the operation and sectionalizing of the electric traction system power distribution within their assigned territory.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Programmable Logic Controller (PLC)

An industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices. PLCs can be found at Jericho Park, Richmond, and Sunnyside converter stations.

Protection

A broad term to indicate that an AMT-2 Qualified and Authorized person has completed a Catenary Isolation, Approved Barrier, Clearance, Third Rail DC Power Permit, Work Permit, Lockout, Tagout, Tryout Procedures, or is allowing Class “D” personnel to work under their direction.

Push-Pull Train

A passenger train with a Multiple Unit (MU) or control car on either end.

Rack-Out Circuit Breaker

A circuit breaker that can be placed in various positions and able to be completely removed from its enclosure for maintenance.

Rail Return System

The combination of running rails, impedance bonds, wires and cables that provide an electrical return path to the substation.

Relay (ANSI/IEEE Standard Device Numbers)

An electrical device that is activated by a current or signal in one circuit to open or close another circuit.

TABLE 24 - ANSI/IEEE STANDARD DEVICE NUMBERS

Device Numbers (the more commonly used ones are in bold)

1 - Master Element	53 - Field Excitation Relay
2 - Time Delay Starting or Closing Relay	55 - Power Factor Relay
3 - Checking or Interlocking Relay	56 - Field Application Relay
4 - Master Contactor	59 - Overvoltage Relay
5 - Stopping Device	60 - Voltage or Current Balance Relay
6 - Starting Circuit Breaker	62 - Time-Delay Stopping or Opening Relay
7 - Rate of Change Relay	63 - Pressure Switch
8 - Control Power Disconnecting Device	64 - Ground Detector Relay
9 - Reversing Device	65 - Governor
10 - Unit Sequence Switch	66 - Notching or jogging device
11 - Multifunction Device	67 - AC Directional Overcurrent Relay
12 - Overspeed Device	68 - Blocking or “out of step” Relay
13 - Synchronous-speed Device	69 - Permissive Control Device
14 - Underspeed Device	74 - Alarm Relay
15 - Speed or Frequency-Matching Device	75 - Position Changing Mechanism
16 - Data Communications Device	76 - DC Overcurrent Relay
20 - Elect. operated valve (solenoid valve)	78 - Phase-Angle Measuring Relay
21 - Distance Relay	79 - AC-Reclosing Relay
23 - Temperature Control Device	81 - Frequency Relay
24 - Volts per Hertz Relay	83 - Automatic Selective Control or Transfer Relay
25 - Synchronizing or Synchronization-Check Device	84 - Operating Mechanism
26 - Apparatus Thermal Device	85 - Pilot Communications, Carrier or Pilot-Wire Relay
27 - Undervoltage Relay	86 - Lockout Relay
30 - Annunciator Relay	87 - Differential Protective Relay
32 - Directional Power Relay	89 - Line Switch
36 - Polarity or Polarizing Voltage Devices	90 - Regulating Device
37 - Undercurrent or Underpower Relay	91 - Voltage Directional Relay
38 - Bearing Protective Device	92 - Voltage and Power Directional Relay
39 - Mechanical Condition Monitor	94 - Tripping or Trip-Free Relay
40 - Field (over/under excitation) Relay	
41 - Field Circuit Breaker	
42 - Running Circuit Breaker	
43 - Manual Transfer or Selector Device	
46 - Rev. phase or Phase-Bal. Current Relay	
47 - Phase-Seq. or Phase-Bal. Voltage Relay	
48 - Incomplete-Sequence Relay	
49 - Machine or Transformer Thermal Relay	
50 - Instantaneous Overcurrent	
51 - AC Inverse Time Overcurrent Relay	
52 - AC Circuit Breaker	

Suffixes indicating zone of protection

B –Bus
G – Ground or generator
L—Line
N –Neutral
T – Transformer
U—Unit

Remote Terminal Unit (RTU)

Hardware that gathers system-wide real-time data from various locations for telemetry and remote control of field equipment to a centralized control center.

Return To Service (RTS)**Reverse Insulated Overlap (RIO)****Roadway Maintenance Machine (RMM)**

A device powered by any means of energy other than hand power which is being used on or near railroad track for maintenance, repair, construction or inspection of track, bridges, roadway, signal, communications, or electric traction systems. Roadway maintenance machines may have road or rail wheels or may be stationary.

Roadway Worker

Any employee of a railroad or of a contractor to a railroad whose duties include inspection, construction, maintenance, or repair of railroad tracks, bridges, roadway, signal and communication systems, electric traction systems, roadway facilities, or roadway maintenance machinery on or near track or with the potential of fouling a track. (The term also encompasses flagmen and watchmen/lookouts as defined within Amtrak System Roadway Worker Protection Manual).

Roadway Worker In Charge (RWIC)

A roadway worker who is qualified to establish on-track safety for roadway work groups, and lone workers qualified to establish on-track safety for themselves.

Rotary Frequency Converter (RFC)

Rotating Frequency Converters are large motor generator sets consisting of a 60 Hz, three-phase motor with a 13.2 kV input that drives a 25 Hz, single-phase generator with an output of 13.2 kV. The mechanical energy of the motor drives a shaft coupled with the generator to produce the electrical energy required for distribution to the step-up station.

SCADA Tags

In the context of SCADA software, a tag that contains a value, timestamp, and quality characteristics depending on type and application:

- **EPPS Tag**
- **Clearance Tag**
- **Work Permit Tag**
- **Information Tag**

Secondary Circuits

Circuits supplied from transformer output windings that are electrically separated from the input windings.

Section Break (SB)

A location designed to provide a separation of catenary circuits while allowing for a continuous collection of power from the catenary utilizing a section insulator. Under normal operating conditions catenary circuits are of the same nominal voltage and frequency and are in phase. Equivalent to a location where a section insulator is installed. Synonyms: break, overlap, reverse overlap.

Section Insulator

A device that provides electrical separation between two catenary circuits while allowing the smooth passage of a pantograph. When a pantograph is in a section insulator it is connected to both circuits simultaneously. Synonyms: Kupler, Flurry, Melamine, Sleds. Typical simplified arrangement shown:

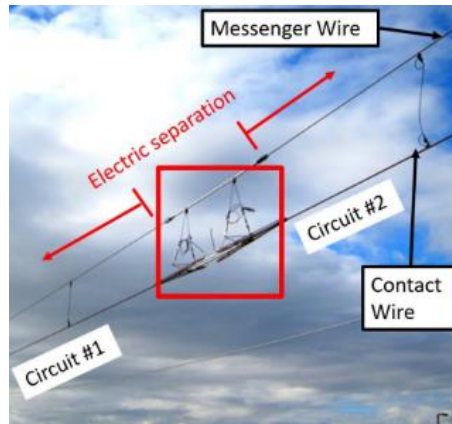


FIGURE 44 - TYPICAL SIMPLIFIED ARRANGEMENT OF SECTION INSULATOR

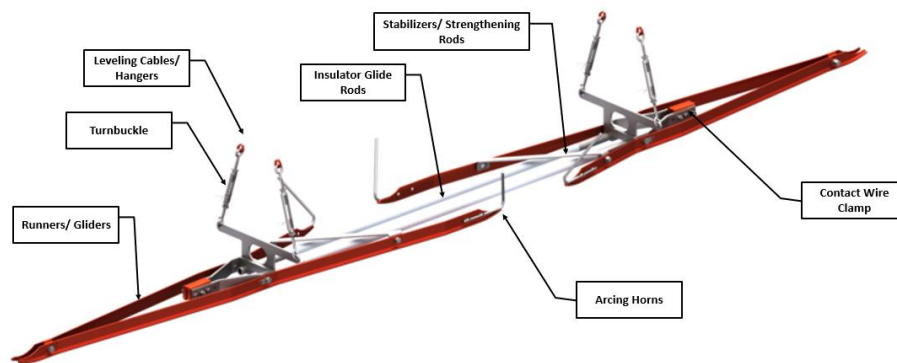


FIGURE 45 - TYPICAL SECTION INSULATOR COMPONENTS

Sectionalizing Switch

Apparatus which is used to isolate or connect sections of the catenary, signal power, or third rail.

Service and Potential (S&P)

Used to describe both a location to which both a service and potential transformer are connected.

Service Transformer

A transformer used to provide secondary circuit power, such as lighting and control.

Shift Turnover

A transfer of responsibility and information regarding the status of the system from the outgoing to incoming Load Dispatcher or Power Director.

Signal (Sig)

Communicate by aspect (position or light) to an equipment operator the indication (speed or action).

Signal Mast, Signal Bridge, Signal Cantilever

Structures which signals are mounted. When a signal is located on the ground it is known as a dwarf signal.

Signal Flip

A term used when the direction of signal power current feed to the signal line must be changed, potentially causing signals to drop/lose aspect/indication.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Signal Machine

A strategically located motor-generator or static unit that generates power for the signal power system.

Signal Power Cut Section (CS)

A location along signal power system that allows for sectionalizing and/or conversion of signal power to 120/240/480-volts to be utilized for central instrument houses, relay cases, interlocking appliances, etc.

Electric Traction is responsible for maintaining, Disconnect switches, Step-down transformer, Lightning arresters, and Fused cutouts. C&S is responsible for maintaining secondary circuits from transformers to signal houses and its equipment (i.e., signal track circuits/signal relays).

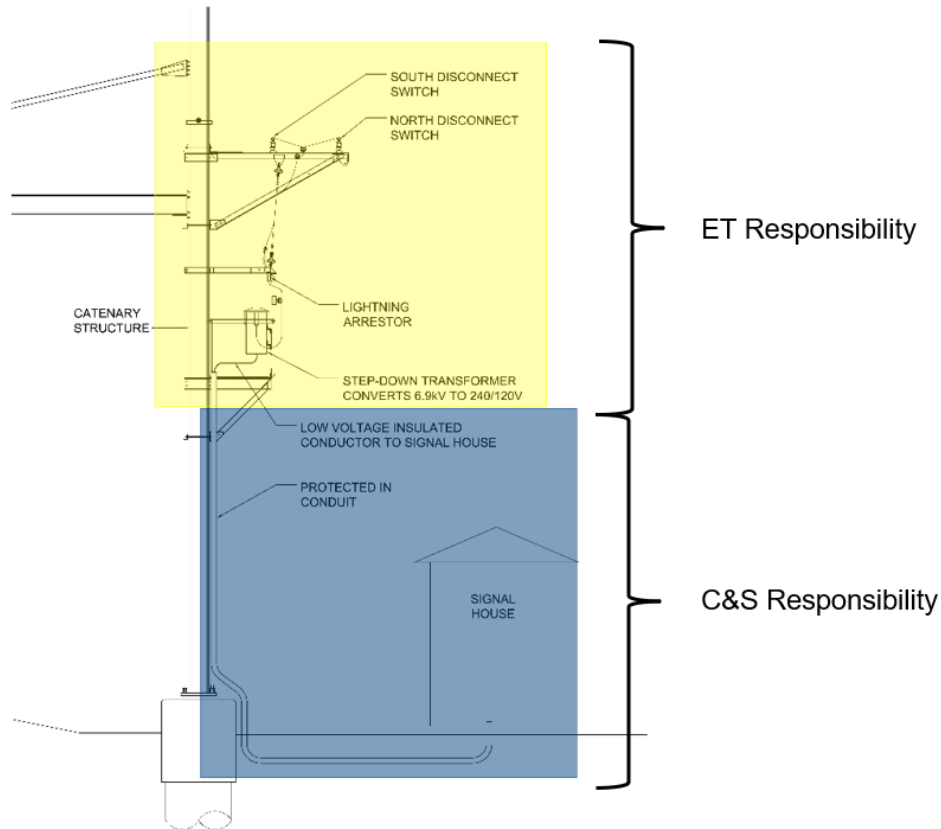


FIGURE 46 - SIGNAL POWER CUT SECTION RESPONSIBILITY

Typical simplified arrangements shown:

- **Single Bank**

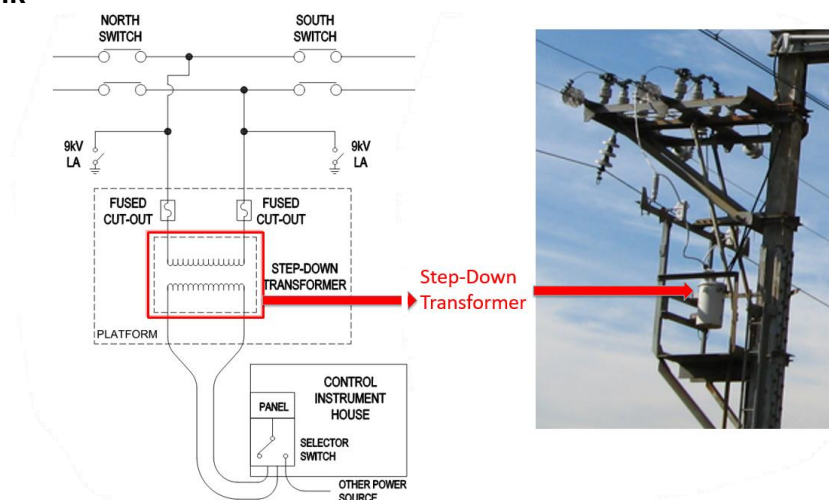


FIGURE 47 - SINGLE BANK CUT SECTION

AMT - 2 ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- **Double Bank**

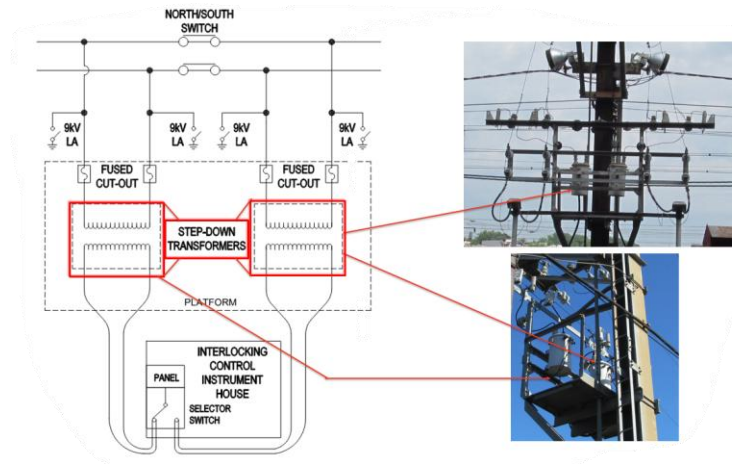


FIGURE 48 - DOUBLE BANK CUT SECTION

Signal Power System

System used to provide electrical power to operation of signals and various C&S components. A simplified arrangement shown:

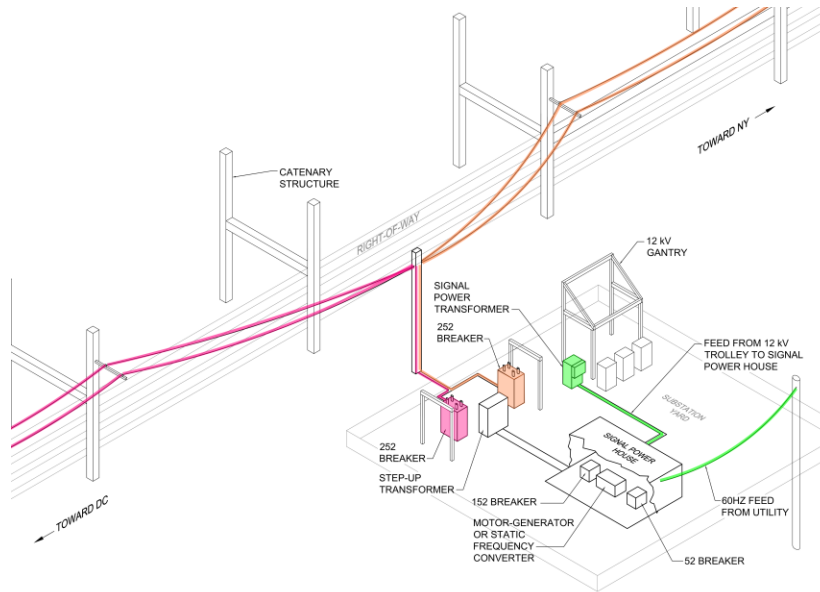


FIGURE 49 - SIGNAL POWER SYSTEM

Signal Track Circuits

Low voltage (1.5 to 12 VDC) 91 2/3 or 100 Hertz relayed track circuits that allows displaying of signal aspects signals semi-automatically.

Silicon Controlled Rectifier (SCR)

A power electronic component that cuts and pastes the three-phase voltage to develop the single-phase 25 Hz voltage. Can be found at Amtrak's Jericho Park converter station.

Solid Hold

A term to describe the restriction on the movement of all electric equipment within a specified area. Generally issued by the Power Director to a Train Dispatcher.

Static Frequency Converter (SFC)

Converts the frequency of an alternating current power source from one frequency to another with electrical components.

Detailed rules and procedures designed to ensure the safe and efficient operation of Amtrak's railroad.

Electrically grounded wire, bonded to catenary poles and supporting structures, which protects system from lightning, static discharge, and inductance by providing a low resistance path to ground.

A cable used in a cross-catenary structure that stabilizes auxiliary and contact wires.

Assemblies that support the catenary of each track independently, using rigid pipes. Note the pipes are bonded to the catenary and thus at the same operating voltage. A simplified arrangement shown:

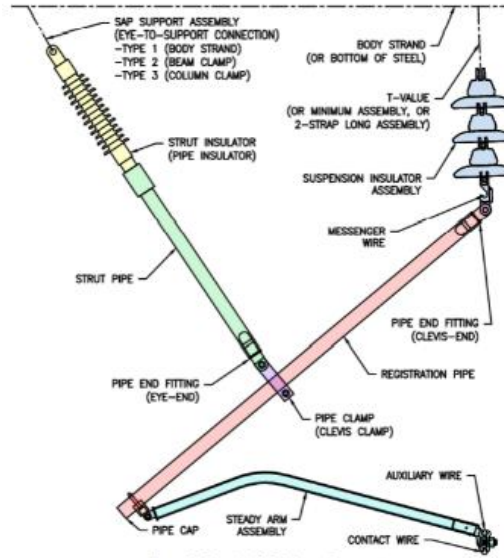


FIGURE 50 - STEADY AND PULL-OFF (SAP) ASSEMBLY

A location where electrical power is received and changed to required voltages and/or characteristics for distribution to the catenary, third rail, and other electric apparatus. Simplified arrangements shown:

The diagram illustrates the electrical configuration of a 138 kV to 12 kV power transformer station. The main transformer is labeled "138kV to 12kV 4.5 MVA Step-down Power Transformer". It has a high-voltage side connected to a "Transmission Line" via an "Air-Break Switch" and a "Ground Switch". The low-voltage side of the transformer is connected to a "12 kV LB Low-Side Circuit Breaker" through an "LT Disconnect" and an "LC Disconnect". This circuit breaker is also connected to a "Return Bus" and a "12 kV Trolley Circuit Breaker" via an "LB Disconnect". The "12 kV Trolley Circuit Breaker" is connected to a "Trolley Switch" and a "To Catenary Trolley" line. A "Ground Grid" is shown at the bottom, connected to the "Return Bus" and the "Trolley Switch". A "To Trolley Switches" line is also shown. A "12 kV Bus" is connected to the "Return Bus" and the "12 kV Trolley Circuit Breaker". A "To Return Rail via Impedance Drain Bond" line is shown. A "To Ground / Return Rail" line is also shown.

FIGURE 51 - SIMPLIFIED ARRANGEMENT OF 25 HZ SUBSTATION

AMT - 2 ELECTRICAL OPERATING RULES AND INSTRUCTIONS

- **60 Hz System**

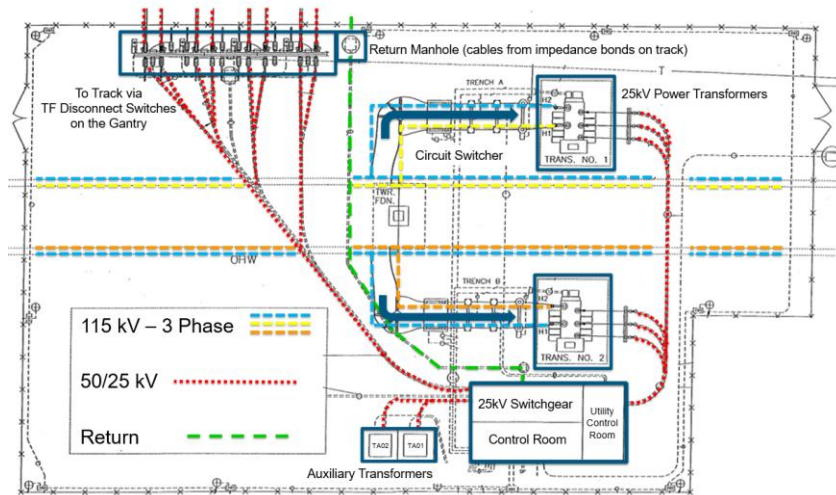


FIGURE 52 - SIMPLIFIED ARRANGEMENT OF 60 Hz SUBSTATION

Sulfur Hexafluoride (SF6)

A colorless, odorless, tasteless, non-toxic, noncorrosive, non-flammable chemically inert gas used as an insulating medium in electric equipment. SF6 gas is heavier than air and tends to collect in low places, it can exclude oxygen and cause asphyxiation in low lying areas and confined spaces.

Supervisory Control and Data Acquisition (SCADA)

A system of remote control and telemetry used to monitor and control Amtrak's generation, transmission, signal power and distribution components. SCADA monitors substations, transformers, and other electrical assets.

Switch (Sw)

(1) An electrical switch is device that interrupts the current flow in a circuit.

(2) A track switch is device consisting of necessary rails and connections designed to divert a movement from the track on which it is moving to another track.

Switching

The operation of any electrical switchgear.

Switching Station

An arrangement of feeders, breakers and switchgear designed to maintain continuity or isolate between substations and strategically located in high volume traffic areas where it may not be practical or necessary to have power transformers. A simplified arrangement shown:

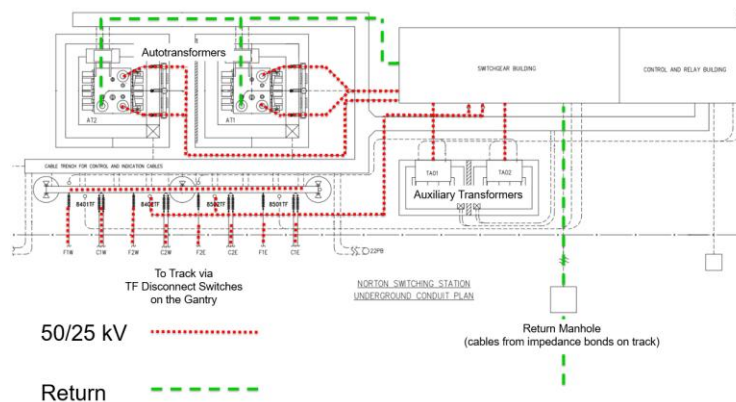


FIGURE 53 - SWITCHING STATION

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Temporary Protective Ground

A temporary electrical connection made to the rail return circuit or other earth potential that is used to protect personnel, equipment and property when work is performed in the electric traction system.

- Rail Ground (RG)
- Aerial/Pole Ground (AG)
- Grounded Pantograph (PAN)
- Platform/Deck/Cat Car Grounds (DG)
- Equipment Grounds

Third Rail

An electrified DC rail located alongside and above the inner/near running rail from which a sliding contact shoe attached to the truck of electric equipment collects direct current.

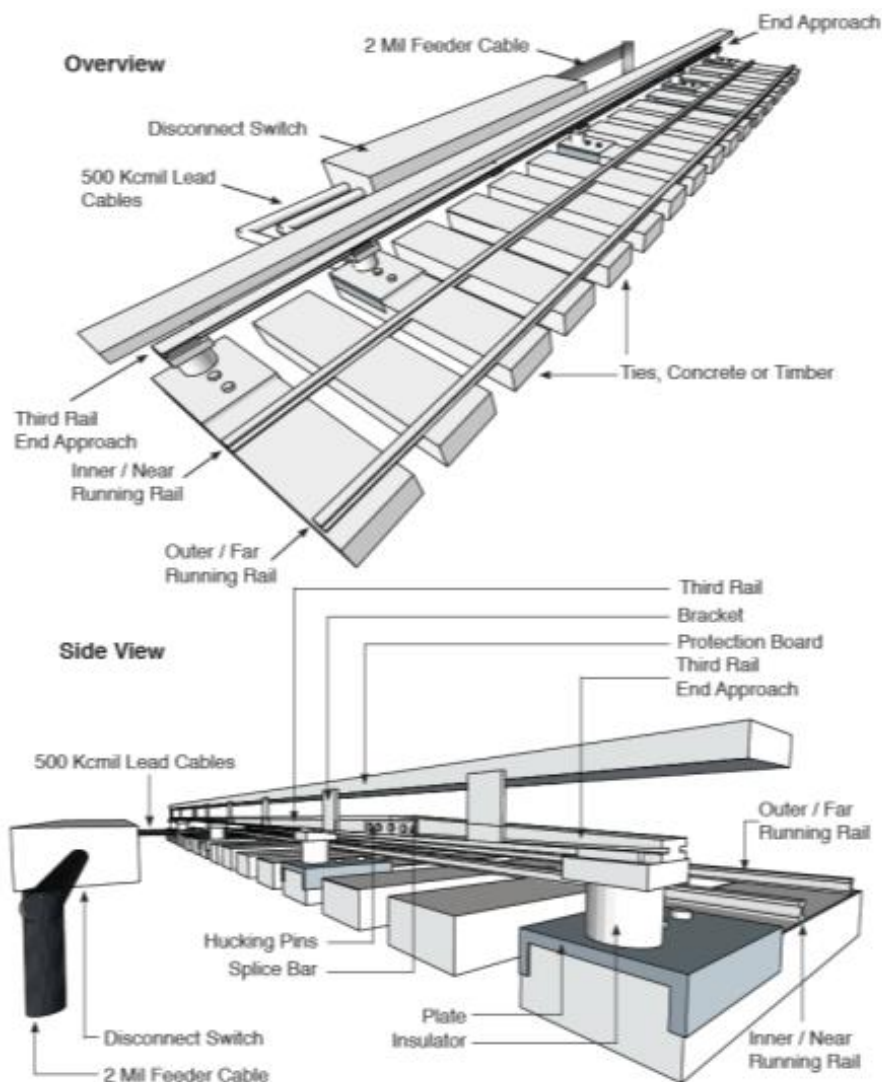


FIGURE 54 - THIRD RAIL SYSTEM

Third Rail Gap

A break or separation in the third rail, which begins and ends with an End Approach.

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Third Rail DC Power Permit

The procedure to remove power from and apply third rail warning devices to third rail circuits/apparatus in electrified territory as governed by Minimum Approach Distances.

Third Rail DC Power Permit Forms

Documents that record steps taken between the Power Director (NEC 70A & NEC 70.E) and Class "A" Employee (NEC 3285/NEC 3499) when it is necessary to remove power from and apply third rail warning devices to third rail circuit(s)/apparatus(es) in electrified territory.

Third Rail Shoe (Contact Shoe)

A device located on the side of electric equipment that collects electric power from the third rail by means of a sliding contact.

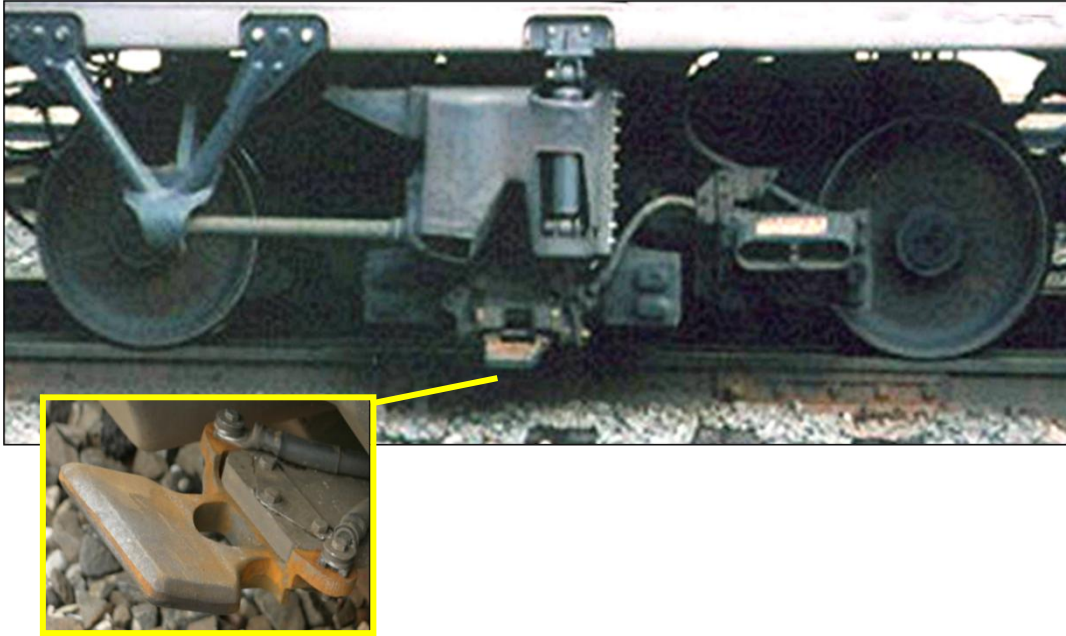


FIGURE 55 - THIRD RAIL SHOE

Third Rail Warning Device

A device attached between the third rail and inner/near running rail, which indicates an energized or de-energized circuits/apparatus.

Three-Part Communication

A method used to communicate crucial details that involve the safety and operational integrity of the railroad or its systems, where:

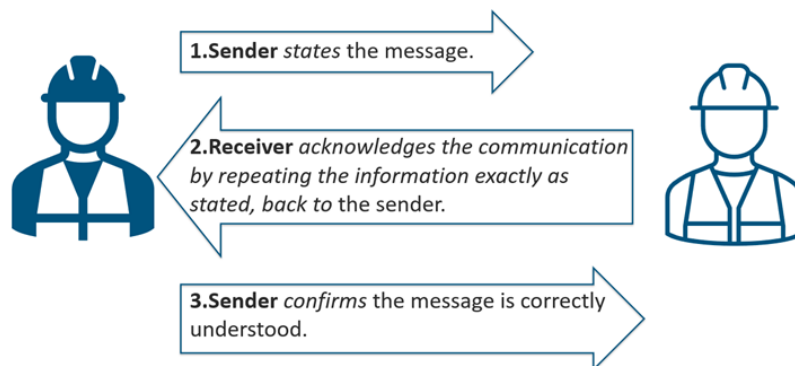


FIGURE 56 - THREE-PART COMMUNICATION

Tie Switch (TS)

A mechanical switching device, either motor or manually operated, that is closed to connect two buses or segments of the catenary system, the third rail system, the transmission system, or signal power system together.

Track (Trk)**Track Car (TC)**

Equipment, other than trains, operated on a track for inspection or maintenance.

Track Heater Station (HS, HT or HTR)

Used to designate a location where catenary is tapped to a switch heater unit substation and power is fed to C&S track heaters for melting snow and ice from rail switches.

Track Occupancy Light (TOL)

Used to track train movement. During a signal power failure, C&S track circuits will fail showing TOL's in the affected area. A Train Dispatcher's ability to display signals and visually monitor train movement over those sections are absent. The CETC system display will indicate in red those sections of the railroad effected.

Train

An engine or more than one engine coupled, with or without cars, displaying a marker.

Transformer (XFMR)

Apparatus which serves to increase or decrease voltage.

Transmission Lines

A system of wires and/or cables, used to transmit power at high voltage between central generating stations and substations.

Transmission System

An interconnected group of lines and associated equipment for the movement or transfer of electric energy between points of supply and points at which it is transformed for distribution or delivered to other electric systems.

Transposition

Consist of two wires or "legs," designated Phase 'A' and Phase 'B'. These wires are 180 degrees out of phase with each other. On uninsulated or bare aerial cables these lines are crossed at strategic locations. On insulated cables these lines are twisted pairs. Simplified arrangements shown:

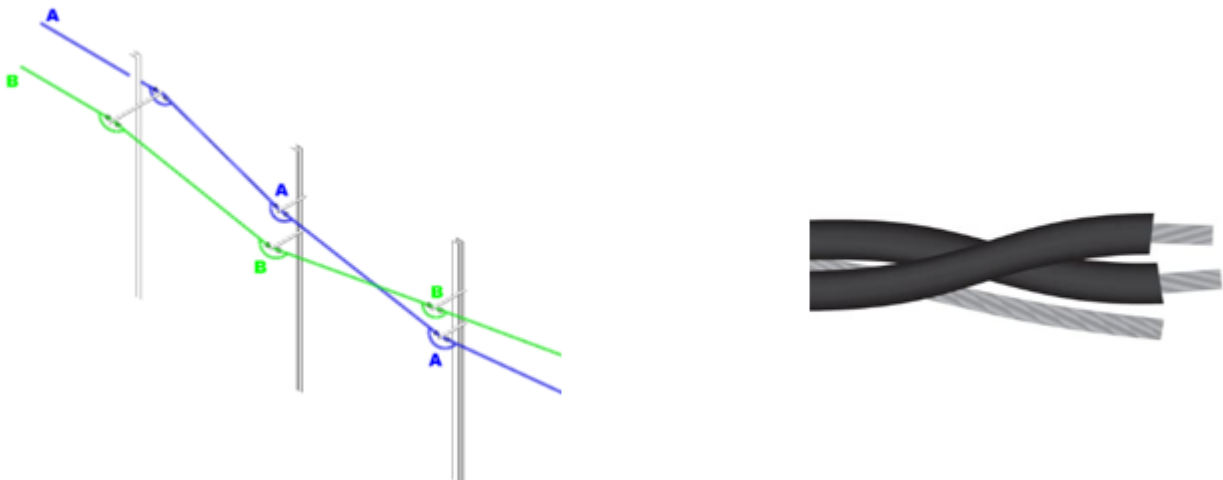


FIGURE 57 - TRANSPOSITION OF WIRES

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Trolley (T)

Trolley Breaker

A circuit breaker used in the traction power distribution system to supply electrical power to the overhead catenary system for the propulsion of electric equipment.

Trolley Feeder (TF)

Trolley Feeder Ground (TFG)

Trolley Switch (T Switch)

Undergrade (UG)

Unit Substation

12kV to 480V step-down transformers and associated switch gear.

- **Signal Power Unit Substation**
Used to provide 480V power for the signal power static frequency converters.
- **Switch Heater Unit Substation**
Used to provide 480V power for C&S to power interlocking track switch heaters.

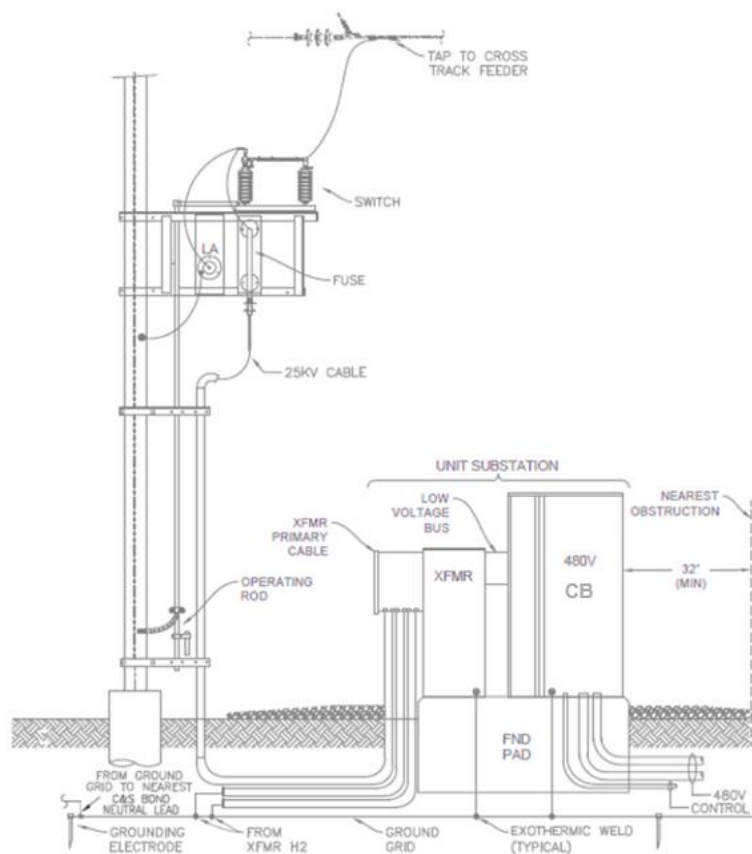


FIGURE 58 - UNIT SUBSTATION

Voltage

Electric potential or potential difference expressed in volts.

Voltage Sensing Device

A device used to test whether circuit(s)/apparatus are energized or de-energized. This may be in the form of a multimeter. Synonym: tic tester/tracer or voltage detector/tester.

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Wayside HEP Power Systems

Feed 480 volt, three phase power from the electric utility to the train through the HEP system or a dedicated "yard power" connector. Synonym: Yard Power Units, Wayside Power Units, Wayside Power Panels, Shop Power, Ground Power.



FIGURE 59 - WAYSIDE HEP POWER SYSTEM

Work Permit

The procedure to receive permission to work on Electric Traction System circuits/apparatus with special instructions given by the Power Director and no temporary protective grounds are applied.

Work Permit Forms

Documents that record steps taken between the Power Director (NEC 85) and Class "A" Employee (NEC 261) when required to repair or test devices, when an electrical clearance is not required.

Yard (Yrd)

A system of tracks used for the making up of trains and storing of cars. Movements in a yard must be made at Restricted Speed.

Yard Master (YM)

12. Illustration of Forms

12.1 Do Not Operate Tag - Red Tag (NEC 105)

The image shows a red tag with a white circular hole at the top. The tag is divided into two main sections. The left section contains the text "DO NOT OPERATE" in large, bold, black capital letters. The right section contains a form for recording electrical work details.

Form Fields:

- Apparatus or Circuit No.:** A line for recording the apparatus or circuit number.
- Person in Charge:** A line for recording the person in charge.
- Nature of Work:** A line for recording the nature of the work.
- Tag Placed By:** A line for recording the person who placed the tag.
- Tag Removed By:** A line for recording the person who removed the tag.
- Location:** A line for recording the location of the work.
- NO.:** A line for recording the tag number.
- Temporary Operation:** A table with three columns: Off, ON, and BY.

Table:

Temporary Operation		
Off	ON	BY

When this tag has served its purpose and is properly filled, it must be sent to:

AMTRAK
National Railroad Passenger Corporation
NEC 105 (04/09)

FIGURE 60 - DO NOT OPERATE TAG - RED TAG (NEC 105)

12.2 Inspected and Approved Barrier Tag – Green Tag (NEC 101)

NEC – 101	
INSPECTED AND APPROVED BARRIER TAG	
AMTRAK ELECTRIC TRACTION DEPARTMENT	
Work may commence at this location for the duration shown below and as long as the structural integrity of the approved barrier remains unchanged for all of the work within the agreed upon job scope. Any changes to the scope of the project, personnel involved, or the condition of the barrier must be reported immediately to the Amtrak Power Director's Office. Work performed in areas protected by this barrier is limited to tasks that can be accomplished using hand tools or light power equipment. Any task that requires equipment that could potentially damage or breach the barrier must be coordinated with Amtrak ET and will likely require protection by a qualified Amtrak Class "A" Employee and possible power outages or adjustments to rail operations. Periodic inspections will be made to the job site to ensure compliance with all Amtrak rules. Failure to comply with the rules will result in a job shut down and delays to work.	
Job Scope: _____	
Company: _____	
Responsible Party Name: _____	Phone: _____
Detailed Location & MP: _____	
Highest Voltage Beyond Barrier: _____	MAD: _____
Tag Number: _____	Project Start Date: _____
Inspected by Name: _____	Date: _____
Approved by Name: _____	Date: _____
Sign: _____	
Power Director Phone Number: _____	Zone: _____
Amtrak Police Department: 1-800-331-0008	
ALWAYS MAINTAIN MINIMUM APPROACH DISTANCE TO WIRES NOT PROTECTED BY THIS BARRIER	

FIGURE 61 - INSPECTED AND APPROVED BARRIER TAG – GREEN TAG (NEC 101)

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

12.3 Plate Order Form (NRPC 2990)



NORTHEAST CORRIDOR PLATE ORDER FORM SIDE – A

NRPC 2990 (revised 5/4/2026)

This form must be completed by employees who are in charge of affected tracks before permission to remove catenary or third rail power is granted to the power director. Train dispatchers who complete this form must issue it to all affected block operators under their supervision before making it effective. Yardmasters completing this form must ensure that proper protection within yards and maintenance facilities (when applicable) is in place as required by rules and special instructions. All blocking devices, hand operated switches, locks and tags to protect the affected plate(s) where applicable, must be applied before catenary or third rail is deenergized.

Trains and engines held by this Plate Order must not be permitted to enter the territory it protects, nor may any pantographs be raised, until this Plate Order has been cancelled or a "Temporary Release" has been authorized by the power director.

When this form is issued at locations where more than one employee can authorize movement into affected track(s), all employees involved must read and comply with it.

- (PO#) Plate Order Number: _____ Date: ____ / ____ / ____
1. Plate No(s). _____ Requested by Power Director: _____ at ____: ____ M
2. To: _____
3. Hold all _____ electric trains and engines clear of tracks affected by Plate No(s). _____
4. Blocking Devices Applied (BDA): _____
5. All pantographs/3R shoes within plate limits are lowered/removed/MCB Opened Yes ☐ No ☐ Not Applicable ☐
H/O switch(es) locked and tagged by: _____ for: _____
6. Time effective: ____: ____ M Issued by: _____ Copied by: _____
7. Permission to remove power granted to Power Director: _____ at ____: ____ M
8. Final Release to Plate No(s). _____ by Power Director: _____ at ____: ____ M
9. PO# _____ Cancelled at: ____: ____ M Date: ____ / ____ / ____ By: _____ Copied by: _____

Instructions for Plate Order Completion

1. To be completed by issuing employees only and read back to the power director for accuracy.
2. Insert title and location of employees under your jurisdiction who control entrance to track(s) affected by the plate(s) listed. If no other employees are involved, insert your title and location.
3. Insert AC electric, DC electric or ALL electric trains, and the numbers of all plates affected.
4. **Train dispatcher, director or operator** - Record blocking devices applied.
5. **Yardmaster or other employee in charge** - Record that no raised pantographs, third rail shoes exist if any electric equipment is within the limits of affected plate(s) or their MCBs have been opened and tagged. Additionally, hand-operated switches are verified locked and tagged "by" employee named and "for" the yardmaster or employee directing locks and tags to be applied. (To be completed only **after** proper locking and tagging protection has been afforded.) If Plate Order is issued to other employees, receiving employees must correctly repeat all information dictated to them before this line is completed. Name of employee "Copied by" must be shown whenever line is copied by a person other than the issuing employee.
6. To be completed by issuing employee only and repeated by Power Director.
7. To be completed by issuing employee only and read back to Power Director. If all plate numbers listed on Line 3 of this form are not released, a new Plate Order, listing the plates remaining in effect, must be issued before this Plate Order is cancelled.
8. To be completed only after all plates listed on Line 3 have been released or transferred to another Plate Order. It must be read to, and correctly repeated by all employees issued the Plate Order. Once this Plate Order is cancelled, affected employees must draw an "X" through the entire face of this form. Blocking devices or locks and tags applied to protect this Plate Order may not be removed unless their application is required for another reason, alternate protection is provided and is authorized by employee in charge of protection. Name of employee "Copied by" must be shown whenever line is copied by someone other than issuing employee.
9. Fill in the Plate Order Number, cancellation Time and Date (AM/PM) by the approving employee and any employee copying such cancellation.

This form must be retained for a period of 14 days after cancellation.

FIGURE 62 - PLATE ORDER FORM (NRPC 2990) SIDE A

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Location	Signal(s)	Switch(es)	Time Removed	Time Reapplied

RECORD OF BLOCKING DEVICE REMOVAL AND LOCK REMOVAL/REAPPLICATION: Use the space below to record the removal and reapplication of blocking devices and/or switch locks when authorizing movements that will not affect this Plate Order.

RECORD OF TEMPORARY RELEASE: Use the space below to record any Temporary Releases granted by the Power Director and associated removal and reapplication of protection. Areas enclosed by double lines are to be completed by the issuing employee only. On the line labeled "Issued To:", insert the title and location of employees who control entrance to tracks affected by the plate(s) listed. If no other employees are involved, insert your own title and location.

Temporary Release from Plate No(s): _____ Date: ____/____/____ Granted by Power Director: _____ at: ____:____ M Trains or engines may use track(s) affected by Plate No(s): _____ Issued To: _____ Title / Last Name _____ Effective Time _____ Blocking Devices or Lock(s) Removed:	(For Reestablishment of protection at end of Temporary Release) Trains or Engines must NOT use track(s) affected by Plate No(s): Blocking Devices or Locks Reapplied: Issued To: _____ Date: ____/____/____ Dspr/Yd Master: _____ Effective: ____:____ M Permission to Remove Power from Plate No(s): _____ To Power Director: _____ at: ____:____ M
Temporary Release from Plate No(s): _____ Date: ____/____/____ Granted by Power Director: _____ at: ____:____ M Trains or engines may use track(s) affected by Plate No(s): _____ Issued To: _____ Title / Last Name _____ Effective Time _____ Blocking Devices or Lock(s) Removed:	(For Reestablishment of protection at end of Temporary Release) Trains or Engines must NOT use track(s) affected by Plate No(s): Blocking Devices or Locks Reapplied: Issued To: _____ Date: ____/____/____ Dspr/Yd Master: _____ Effective: ____:____ M Permission to Remove Power from Plate No(s): _____ To Power Director: _____ at: ____:____ M

FIGURE 63 - PLATE ORDER FORM (NRPC 2990) SIDE B

12.4 Do Not Operate – Plate Tag (NEC 106)

Side A

 **AMTRAK®**

DO NOT OPERATE

THIS SWITCH OR APPARATUS IS PROTECTED BY ORDER OF:

TITLE/NAME: _____

When this tag is displayed on the control stand of a locomotive, no operations may be performed unless authorized by title or name of the individual above.
When this tag has fulfilled its purpose and is removed, it must be retained by the person directing its use for 14 days.

NEC 106 (9/2020) Amtrak is a registered service mark of the National Railroad Passenger Corporation.

DO NOT OPERATE THIS SWITCH OR APPARATUS

Switch or Apparatus Number: _____ **Plate Order Number(s):** _____

Initially Placed By: _____

Date: ____/____/____ **Time:** ____:____ M

Nature of Work: _____

Final Removal By: _____

Location: _____ **Date:** ____/____/____ **Time:** ____:____ M

Temporary Operation		
Time OFF	Time ON	Initials BY

Temporary authorization to operate this switch or apparatus may only be granted by the title or name shown on "Side A". "OFF" represents time/date protection is released. "ON" represents time/date protection is reapplied. "BY" the qualified and authorized individual.

NEC 106 (9/2020)

FIGURE 64 - DO NOT OPERATE – PLATE TAG (NEC 106)

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS
12.5 Electric Traction Power Clearance Form (NEC 260)


Electric Traction Power Clearance Form

Clearance No: _____ Day: _____ Date: _____ Time Requested: _____ ☐ AM ☐ PM

Power must be removed from: _____ On account of: _____ Location: _____

Remarks: _____

Ordered opened/ checked open:		Opened/ checked open by:		Ordered closed/ checked closed:		Closed/ checked closed by:	
Device:	Time:	Person:	Time:	Device:	Time:	Person:	Time:

138 kV ground switch checked closed by: _____ Location: _____ at: _____ ☐ AM ☐ PM

_____ Employee Permission to test (circuit/apparatus) de-energized at: _____ ☐ AM ☐ PM

_____ tested (circuit/apparatus) de-energized at: _____ ☐ AM ☐ PM

Day: _____ Date: _____ To: _____ Power has been removed from the following circuit/apparatus:

Permission to ground above circuit/apparatus: Time effective: _____ ☐ AM ☐ PM Power Director: _____

No. of Grounds applied: _____ Class "A" Employee: _____

Clearance Issued (Print/ Sign)

Location of Grounds: _____

Clearance explained and understood:		Clearance released and understood:	
Print	Sign	Print	Sign
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
4.	4.	4.	4.
5.	5.	5.	5.
6.	6.	6.	6.
7.	7.	7.	7.
8.	8.	8.	8.
9.	9.	9.	9.
10.	10.	10.	10.
11.	11.	11.	11.
12.	12.	12.	12.
13.	13.	13.	13.
14.	14.	14.	14.
15.	15.	15.	15.

FIGURE 65 - ELECTRIC TRACTION POWER CLEARANCE FORM (NEC 260) PAGE 1 OF 2

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

No. of Grounds removed: _____ Locations: _____

Clearance No: _____ Day: _____ Date: _____ Power Director: _____

Advised work completed, all personnel clear, grounds ☐ Removed ☐ NOT Removed from following circuit/apparatus:

☐ OK ☐ NOT OK to energize at: _____ ☐ AM ☐ PM Clearance repeated correctly at: _____ ☐ AM ☐ PM

Class "A" Employee: _____

Clearance Released (Print/ Sign)

Temporary Clearance Release			
Clearance released and understood:			
Print	Sign	Print	Sign
1.	1.	7.	7.
2.	2.	8.	8.
3.	3.	9.	9.
4.	4.	10.	10.
5.	5.	11.	11.
6.	6.	12.	12.

No. of Grounds removed: _____ Locations: _____

Clearance No: _____ Day: _____ Date: _____ Power Director: _____

Advised all personnel clear, grounds removed from following circuit/apparatus: *(read body of clearance)*

OK to energize temporary at: _____ ☐ AM ☐ PM Clearance repeated correctly at: _____ ☐ AM ☐ PM

Clearance Reissue	
Employee _____	Permission to test (circuit/apparatus) de-energized at: _____ ☐ AM ☐ PM
	tested (circuit/apparatus) de-energized at: _____ ☐ AM ☐ PM
Clearance No: _____	Day: _____ Date: _____ To: _____

Power has been removed from the following circuit/apparatus: *(read body of clearance)*

Permission to ground above circuit/apparatus: Time effective: _____ ☐ AM ☐ PM Power Director: _____

No. of Grounds applied: _____ Locations: _____

Clearance explained and understood:			
Print	Sign	Print	Sign
1.	1.	7.	7.
2.	2.	8.	8.
3.	3.	9.	9.
4.	4.	10.	10.
5.	5.	11.	11.
6.	6.	12.	12.

Transfer of Clearance					
Employee/ Power Director Office	Time	Date	Power Director	No. of Grounds	Ground Locations

NEC- 260 (06.22)

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FIGURE 66 - ELECTRIC TRACTION POWER CLEARANCE FORM (NEC 260) PAGE 2 OF 2

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS
Temporary Clearance Release

No. of Grounds removed: _____

Clearance No: _____ Day: _____ Date: _____ Employee: _____

Reports all personnel clear, grounds removed from following circuit/apparatus:

OK to energize temporary at: _____ ☐ AM ☐ PM Energized at: _____ ☐ AM ☐ PM

Location	Device Closed	Time	Train Dispatcher/ Others	Plate(s)	Released Time

Power Director: _____

Clearance Released (Print/ Sign)

Clearance Reissue

Train Dispatcher/ Others	Plate(s)	Time Notified	Permission Time	Location	Device Opened	Time

Employee

Permission to test (circuit/apparatus) de-energized at: _____ ☐ AM ☐ PM

tested (circuit/apparatus) de-energized at: _____ ☐ AM ☐ PM

Clearance No: _____ Day: _____ Date: _____ To: _____

Power has been removed from the following circuit/apparatus: *(read body of clearance)*

Permission to ground above circuit/apparatus: Time effective: _____ ☐ AM ☐ PM Clearance repeated correctly at: _____ ☐ AM ☐ PM

No. of Grounds applied: _____

Power Director: _____

Clearance Reissued (Print/ Sign)

Location of Grounds: _____

Transfer of Clearance No. _____

Circuit/apparatus: _____

Employee/ Power Director Office	Time	Date	Power Director	No. of Grounds	Ground Locations

NEC 84

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ELECTRICAL OPERATING RULES AND INSTRUCTIONS

12.7 Electric Traction Power Director Clearance Transfer Extension Form (NEC 84.E)



Electric Traction Power Director Clearance Transfer Extension Form

Transfer of Clearance No. _____

Circuit/Apparatus: _____

[illegible]

FIGURE 69 - ELECTRIC TRACTION POWER DIRECTOR CLEARANCE TRANSFER EXTENSION FORM (NEC 84.E)
PAGE 1 OF 2

Transfer of Clearance No.

NEC 84.E (08.11.23) Amtrak is a registered service mark of the National Railroad Passenger Corporation

PAGE 2 OF 2

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AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Transfer of DC Power Permit No: _____

Circuit/apparatus: _____

Transfer of DC Power Permit

Name or Power Director Office	Time	Date	Power Director	No. of Devices	Warning Device Locations

DC Power Permit explained and understood:

Print	Sign	Date
1.	1.	
2.	2.	
3.	3.	
4.	4.	
5.	5.	
6.	6.	
7.	7.	
8.	8.	
9.	9.	
10.	10.	
11.	11.	
12.	12.	
13.	13.	
14.	14.	
15.	15.	
16.	16.	
17.	17.	
18.	18.	
19.	19.	
20.	20.	
21.	21.	
22.	22.	
23.	23.	
24.	24.	
25.	25.	
26.	26.	
27.	27.	
28.	28.	
29.	29.	
30.	30.	
31.	31.	
32.	32.	
33.	33.	

NEC- 3285 (Rev. 06.22)

DC Power Permit released and understood:

Print	Sign	Date
1.	1.	
2.	2.	
3.	3.	
4.	4.	
5.	5.	
6.	6.	
7.	7.	
8.	8.	
9.	9.	
10.	10.	
11.	11.	
12.	12.	
13.	13.	
14.	14.	
15.	15.	
16.	16.	
17.	17.	
18.	18.	
19.	19.	
20.	20.	
21.	21.	
22.	22.	
23.	23.	
24.	24.	
25.	25.	
26.	26.	
27.	27.	
28.	28.	
29.	29.	
30.	30.	
31.	31.	
32.	32.	
33.	33.	

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FIGURE 74 - ELECTRIC TRACTION THIRD RAIL DC POWER PERMIT FORM (NEC 3285) PAGE 2 OF 2

AMT - 2

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

FIGURE 75 - ELECTRIC TRACTION POWER DIRECTOR THIRD RAIL DC POWER PERMIT FORM (NEC 70A)
PAGE 1 OF 2

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Transfer of DC Power Permit No. _____

Circuit/apparatus: _____

[illegible]

Remarks:

[illegible]

NEC 70A (REV. 01/2002)

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FIGURE 76 - ELECTRIC TRACTION POWER DIRECTOR THIRD RAIL DC POWER PERMIT FORM (NEC 70A)
PAGE 2 OF 2

Circuit/apparatus: _____

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Circuit/apparatus: _____

[illegible]

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Remarks:

Employee

tested (circuit/apparatus) de-energized at: ☐ AM ☐ PM

Power has been removed from the following circuit/apparatus:

Time effective: ☐ AM ☐ PM Power Director:

No. of Warning Devices applied: _____ Class "A" Employee: _____

DC Power Permit Issued (Print/Sign)

Location of Warning Devices:

No. of Warning Devices removed: _____ Locations: _____

DC Power Permit No: _____ Day: _____ Date: _____ Power Director: _____

Advised work completed, all personnel, tools and equipment are clear from following circuit/apparatus: (read body of DC power permit)

☐ OK ☐ NOT OK to energize at: ☐ AM ☐ PM DC Power Permit repeated correctly at: ☐ AM ☐ PM

Class "A" Employee:

DC Power Permit Released (Print/Sign)

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AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Transfer of DC Power Permit No: _____

Circuit/apparatus: _____

Transfer of DC Power Permit

Name or Power Director Office	Time	Date	Power Director	No. of Devices	Warning Device Locations

DC Power Permit explained and understood:

Print	Sign	Date
1.	1.	
2.	2.	
3.	3.	
4.	4.	
5.	5.	
6.	6.	
7.	7.	
8.	8.	
9.	9.	
10.	10.	
11.	11.	
12.	12.	
13.	13.	
14.	14.	
15.	15.	
16.	16.	
17.	17.	
18.	18.	
19.	19.	
20.	20.	
21.	21.	
22.	22.	
23.	23.	
24.	24.	
25.	25.	
26.	26.	
27.	27.	
28.	28.	
29.	29.	
30.	30.	
31.	31.	
32.	32.	
33.	33.	

NEC- 3285 (Rev. 06.22)

DC Power Permit released and understood:

Print	Sign	Date
1.	1.	
2.	2.	
3.	3.	
4.	4.	
5.	5.	
6.	6.	
7.	7.	
8.	8.	
9.	9.	
10.	10.	
11.	11.	
12.	12.	
13.	13.	
14.	14.	
15.	15.	
16.	16.	
17.	17.	
18.	18.	
19.	19.	
20.	20.	
21.	21.	
22.	22.	
23.	23.	
24.	24.	
25.	25.	
26.	26.	
27.	27.	
28.	28.	
29.	29.	
30.	30.	
31.	31.	
32.	32.	
33.	33.	

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FIGURE 80 - ELECTRIC TRACTION EMPLOYEE LIRR THIRD RAIL DC LOG FORM (NEC 3499) PAGE 2 OF 2

13. Suggestion Page

Your comments on this document are invited. Please send all suggestions to:

Complete

System ET General Question/Feedback Form

<https://forms.office.com/r/hZ33QB61AU>



Or mail the following to

ET Electrical Operating Rules and Instructions - AMT-2
C/o Deputy Chief Engineer - ET Office
30th Street Station - Box 41
Philadelphia, PA 19104

Please include with each suggestion:

Section No. _____

Subsection No. (If any) _____

Page No. _____

Recommended Changes, Corrections or Questions:

Submitted by: _____

Name: _____

Phone: _____

Email: _____

14. Tables, Figures and Referenced Publications

List of Figures

Figure 1 - Drop Pantograph Hand Signal.....	6
Figure 2 - Maintaining Minimum Approach Distance	14
Figure 3 - Applying Jumpers for Removing Impedance Bond Side Leads	19
Figure 4 - Applying Jumpers for Removing Rail with Impedance Bond.....	19
Figure 5 - Applying Jumpers for Removing Rail with No Impedance Bond	19
Figure 6 - Applying Jumpers For Removing Both Rails With No Impedance Bond.....	20
Figure 7 - Applying Jumpers for Passenger Transfer between Equipment	34
Figure 8 - Transferring Passengers Between Equipment with no Jumpers	34
Figure 9 - Approach Dead Section Sign	35
Figure 10 - Dead Section Sign	35
Figure 11 - Dead Section Stop Sign	35
Figure 12 - Position Light Phase Break Indicator.....	35
Figure 13 - Position Light Phase Break Indicator Sign	36
Figure 14 - Catenary AC Motor Stop Sign	36
Figure 15 - Switch AC Motor Stop Sign	36
Figure 16 - Raising Pantograph Sign	36
Figure 17 - Ground Flag	36
Figure 18 - Section Break Sign	36
Figure 19 - Worn Carbon Strip	41
Figure 20 - Chipped Carbon Strip	41
Figure 21 - Broken Carbon Strip	41
Figure 22 - Typical Balance Weight Assembly at Dead Ends	76
Figure 23 - Body Span	77
Figure 24 - Buffer Zone Schematic	78
Figure 25 - Catenary Maintenance Vehicle.....	78
Figure 26 - Collector Head Assembly	79
Figure 27 - Constant Tension Support Structure	80
Figure 28 - Dead Section Schematic	81
Figure 29 - Amtrak AC Electrified Territory	82
Figure 30 - End Approach	82
Figure 31 - Fixed Termination	83
Figure 32 - Cross-Catenary Structure	84
Figure 33 - K-Frame Structure	84
Figure 34 - Overhead Bridge.....	85
Figure 35 - Signal Bridge	85
Figure 36 - Cantilever Structure	85
Figure 37 - Hucking.....	86
Figure 38 - Standard Impedance Bond Arrangement.....	87
Figure 39 - Motor Mechanism	89
Figure 40 - Pantograph Assembly.....	91
Figure 41 - Paralleling Station	91
Figure 42 - Phase Break Schematic	92
Figure 43 - Plate Schematic	92
Figure 44 - Typical Simplified Arrangement of Section Insulator.....	95
Figure 45 - Typical Section Insulator Components	95
Figure 46 - Signal Power Cut Section Responsibility.....	96
Figure 47 - Single Bank Cut Section.....	96
Figure 48 - Double Bank Cut Section	97
Figure 49 - Signal Power System.....	97
Figure 50 - Steady and Pull-Off (SAP) Assembly	98
Figure 51 - Simplified arrangement of 25 Hz Substation	98
Figure 52 - Simplified Arrangement of 60 Hz Substation.....	99

ELECTRICAL OPERATING RULES AND INSTRUCTIONS

Figure 53 - Switching Station	99
Figure 54 - Third Rail System	100
Figure 55 - Third Rail Shoe	101
Figure 56 - Three-Part Communication	101
Figure 57 - Transposition of Wires	102
Figure 58 - Unit Substation	103
Figure 59 - Wayside HEP Power System	104
Figure 60 - Do Not Operate Tag - Red Tag (NEC 105)	105
Figure 61 - Inspected and Approved Barrier Tag – Green Tag (NEC 101)	106
Figure 62 - Plate Order Form (NRPC 2990) Side A	107
Figure 63 - Plate Order Form (NRPC 2990) Side B	108
Figure 64 - Do Not Operate – Plate Tag (NEC 106)	109
Figure 65 - Electric Traction Power Clearance Form (NEC 260) Page 1 of 2	110
Figure 66 - Electric Traction Power Clearance Form (NEC 260) Page 2 of 2	111
Figure 67 - Electric Traction Power Director Clearance Form (NEC 84) Page 1 of 2	112
Figure 68 - Electric Traction Power Director Clearance Form (NEC 84) Page 2 of 2	113
Figure 69 - Electric Traction Power Director Clearance Transfer Extension Form (NEC 84.E) Page 1 of 2	114
Figure 70 - Electric Traction Power Director Clearance Transfer Extension Form (NEC 84.E) Page 2 of 2	115
Figure 71 - Electric Traction Employee Electrical Work Permit Form (NEC 261)	116
Figure 72 - Electric Traction Power Director Electrical Work Permit Form (NEC 85)	117
Figure 73 - Electric Traction Third Rail DC Power Permit Form (NEC 3285) Page 1 of 2	118
Figure 74 - Electric Traction Third Rail DC Power Permit Form (NEC 3285) Page 2 of 2	119
Figure 75 - Electric Traction Power Director Third Rail DC Power Permit Form (NEC 70A) Page 1 of 2	120
Figure 76 - Electric Traction Power Director Third Rail DC Power Permit Form (NEC 70A) Page 2 of 2	121
Figure 77 - Electric Traction Power Director Third Rail DC Power Permit Transfer Extension Form (NEC 70.E) Page 1 of 2	122
Figure 78 - Electric Traction Power Director Third Rail DC Power Permit Transfer Extension Form (NEC 70.E) Page 2 of 2	123
Figure 79 - Electric Traction Employee LIRR Third Rail DC Log Form (NEC 3499) Page 1 of 2	124
Figure 80 - Electric Traction Employee LIRR Third Rail DC Log Form (NEC 3499) Page 2 of 2	125

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

List of Tables

Table 1 - Approved Barrier Minimum Clearance	26
Table 2 - Signal Aspects and Indications.....	36
Table 3 - Catenary or Third Rail Inspections	44
Table 4 - Amtrak Emergency Numbers	66
Table 5 - C&S Trouble Desk Telephone Numbers	66
Table 6 - Train Dispatchers, Operators, etc. Telephone Numbers	66
Table 7 - Power Directors and Load Dispatchers Telephone Numbers	67
Table 8 - Foreign Utility Emergency Telephone numbers	68
Table 9 - Transmission System Nominal Voltages and Frequency	69
Table 10 - Transmission System Utility Supply Nominal Voltages and Frequency	69
Table 11 - Overhead Catenary System Nominal Voltage and Frequency	70
Table 12 - Signal Power System Nominal Voltage and Frequency	70
Table 13 - Third Rail System Nominal Voltage	70
Table 14 - Wayside and Head end Power Nominal Voltage and Frequency.....	70
Table 15 - Amtrak Main Line Tracks NOT Equipped for AC Electrical Operation	71
Table 16 - Other Tracks Equipped for AC Electrical Operation	71
Table 17 – Power Directors Assigned Territories	71
Table 18 - Amtrak Main Line Tracks Equipped for DC Electrical Operation	72
Table 19 - AC Minimum Approach Distance.....	73
Table 20 - DC Minimum Approach Distance	73
Table 21 - Dead Section Locations.....	74
Table 22 - Phase Break Locations.....	74
Table 23 - Position Light Phase Break Indicator Location	74
Table 24 - ANSI/IEEE Standard Device Numbers	94

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

List of Reference Publications

Designation	Name	Location
	Amtrak Policy and Instruction Manual (APIM)	Amtrak All Aboard
	Amtrak's Code of Ethics and Standards for Behavior	Amtrak All Aboard
	Amtrak's Safety Programs	Amtrak All Aboard
SP814	Illustrating A, B, C Points and Drain Bond Locations	System C&S SharePoint
Specification No. 16064	Specification for Equipment and Vehicle Grounding Near Energized Overhead Wires	Roadway Equipment and Rolling Stock SharePoint
NRPC 4108	Amtrak Employee Safety Rules	Comply365
NORAC	Northeast Operating Rules Advisory Committee	Comply365
	Amtrak Northeast Corridor Employee Timetable Special Instructions	Comply365
AMT-23	Special Instructions Governing Construction and Maintenance of Signals and Interlockings	Comply365
	Amtrak's Service Standards Manual for Train Service and On-Board Service Employees	Comply365
NRPC 4104	Engineering Job Briefing	Amtrak All Aboard
NRPC 3418	Engineering Fall Protection Job Briefing	Amtrak All Aboard
SOI-101	Procedure for the Development, Revision, and Control of Amtrak Standard Operating Instructions	Comply365/Direct Link
SOI-201	Electric & Arc Flash Protection Program	Comply365/Direct Link
SOI-203	Voltage Testing and Verification	Comply365/Direct Link
SOI-205	Apparatus Testing Safety Plan	Comply365/Direct Link
SOI-207	Using, Maintaining and Electrical Testing Live-Line Tools	Comply365/Direct Link
SOI-209	Work Permit Procedures	Comply365/Direct Link
SOI-210	Annual Qualification, Certification, Climbing Skills, and Pole Top Rescue	Comply365/Direct Link
SOI-211	Electrical Clearance Procedure	Comply365/Direct Link
SOI-212	Temporary Protective Grounding	Comply365/Direct Link
SOI-213	Roadway Machinery and Construction Equipment Grounding in Electrified Territory	Comply365/Direct Link
SOI-214	ET Fall Protection Safety Plan	Comply365/Direct Link
SOI-215	LIRR Third Rail Power Protection Procedures	Comply365/Direct Link
SOI-216	Entering Buildings Containing Gas Insulated Switchgear	Comply365/Direct Link
SOI-219	Safety Equipment for Vehicles and Substations	Comply365/Direct Link
SOI-220	Third Rail Power Permit Procedure	Comply365/Direct Link
SOI-221	Antennas, Transmitter Site Safety Procedures	Comply365/Direct Link
SOI-223	Power Removal Tunnel Emergency	Comply365/Direct Link
SOI-224	Electrical Switching and Tagging	Comply365/Direct Link
SOI-225	ET Commissioning	Comply365/Direct Link
SOI-226	Control House and RTU Batteries	Comply365/Direct Link
SOI-228	ET Construction	Comply365/Direct Link
SOI-229	Procedures to Access Top of AC Electrical Equipment.	Comply365/Direct Link
EP 5100	Bonding and Grounding in Electrified Territory	Comply365
EP 5300	Procedures for Locating Buried Cables	Comply365
EP 7001	General Information About Engineering Practices Electric Traction	Comply365/Direct Link
EP 7001	Fall Protection Procedures for Richmond SFC	Comply365/Direct Link
EP 7002	Catenary Structure Rescue	Comply365/Direct Link
EP 7003	Fall Protection Procedures for Access to Catenary Structure	Comply365/Direct Link
EP 7004	Pole Step Rung Inspection	Comply365/Direct Link
EP 7005	Fall Protection Procedures for Access to Top of Substation Transformer	Comply365/Direct Link
EP 7006	Aerial Lift Fall Protection Supplemental Instruction Concerning Required Clearances Transitioning to Adjacent Structures	Comply365/Direct Link
EP 7007	Electric Traction Department Approved Fall Protection Equipment	Comply365/Direct Link
EP 7008	Underground Signal Power Maintenance and Operation	Comply365/Direct Link
EP 7009	Starlogixs Model EX3-873 80 kV Voltage Detector for Catenary & Signal Power Circuits	Comply365/Direct Link
EP 7010	Procedures for Application of Ground Cables as Jumpers Using Shotgun Sticks	Comply365/Direct Link
EP 7011	Procedures for Requesting Class "C" Employee Minimum Approach Distance for Loram Railvac Equipment in A/C Territory	Comply365/Direct Link
EP 7012	Electric Traction Catenary Inspections – Catenary Geometry Measurements Car Procedures for Recording Exceptions – 10005 Car	Comply365/Direct Link
EP 7013	Procedures for the Safe use of Doble M4100 Testing Instrument on Main Power Transformers	Comply365/Direct Link
EP 7014	Required Equipment & Freight Car Clearances	Comply365/Direct Link

AMT - 2
ELECTRICAL OPERATING RULES AND INSTRUCTIONS

EP 7015	Procedures for Megger Testing of Control and Power Cables	Comply365/Direct Link
EP 7016	Procedures for ET Running Catenary Inspection	Comply365/Direct Link
EP 7017	Maintaining Clearance Form NEC-260	Comply365/Direct Link
EP 7018	Fuse Cutouts	Comply365/Direct Link
EP 7019	Overview of Gas Insulated Switchgear and the Expected Maintenance Practices Interfacing with SF6 gas	Comply365/Direct Link
EP 7020	Battery Maintenance, Inspection, and Installation	Comply365/Direct Link
EP 7021	Signal Power Cut Section Maintenance and Operation	Comply365/Direct Link
EP 7022	Temporary Protective Ground Sets	Comply365/Direct Link
EP 7023	Pre-use Inspection, Operation, and Maintenance Inspection of the NOVA JUPITER Series Static Frequency Converter	Comply365/Direct Link
EP 7024	Procedures for the Safe Installation of Catenary Section Insulators	Comply365/Direct Link
EP 7025	Stepdown Transformers	Comply365/Direct Link
EP 7026	Relay Troubleshooting	Comply365/Direct Link
EP 7027	Cable Trough Installation	Comply365/Direct Link
EP 7028	Unit Substation for Track Switch Heaters and Signal Power	Comply365/Direct Link
EP 7029	Installation of Conduit	Comply365/Direct Link
EP 7030	Catenary Measuring Devices	Comply365/Direct Link
EP 7031	Building Catenary Structures	Comply365/Direct Link
EP 7032	Installation of Switches and Motor Mechanisms	Comply365/Direct Link
EP 7033	Pulling Cable	Comply365/Direct Link
EP 7034	Installation of Steady and Pull-off (SAP) Assemblies	Comply365/Direct Link
EP 7035	Lightning Arresters	Comply365/Direct Link
EP 7036	Repair of Damaged Wires	Comply365/Direct Link
EP 7037	Vacuum Circuit Breakers	Comply365/Direct Link
EP 7038	Installation of Precast Foundations	Comply365/Direct Link
EP 7039	Adjusting Catenary Heights and Stagers	Comply365/Direct Link
EP 7040	Installation and Replacement of Insulators	Comply365/Direct Link
EP 7041	Tree Removal from Lines	Comply365/Direct Link
EP 7042	Installation of Ground Grids and Ground Mats	Comply365/Direct Link
EP 7043	Installation of Fixed Termination Catenary Systems	Comply365/Direct Link
EP 7044	Installation of Constant Tension Catenary Systems	Comply365/Direct Link
EP 7045	Substation Control House Rehabilitation	Comply365/Direct Link
EP 7046	RTU Overview and Troubleshoot	Comply365/Direct Link
EP 7047	Interlocking RTU Hut & WPC Installation	Comply365/Direct Link
EP 7048	Maintaining Third Rail DC Power Permit Form NEC-3285	Comply365/Direct Link
EP 7049	Emergency First Response Equipment	Comply365/Direct Link
EP 7050	Maintaining Electrical Work Permit Form NEC-261	Comply365/Direct Link
EP 7051	Electrical Clearance Procedure for Sunnyside Yard High Speed Rail Building	Comply365/Direct Link
EP 7052	Sump Pumps	Comply365/Direct Link
EP 7053	Procedures for Safe Power Cable Terminations	Comply365/Direct Link
EP 7054	Control Cables	Comply365/Direct Link
EP 7056	Microprocessor Relay Protection	Comply365/Direct Link
EP 7057	Electrical Test Instrument Calibration	Comply365/Direct Link
EP 7058	ET Memos	Comply365/Direct Link
EP 7059	Aerial Program Guide	Comply365/Direct Link
EP 7060	Third Rail Tester and Warning Device	Comply365/Direct Link
EP 7061	Procedure for Missing Sign-off on Power Form	Comply365/Direct Link
EP 7062	Maintaining Do Not Operate Tag - Red Tag (NEC 105)	Comply365/Direct Link
EP 7063	Penn M.G. Signal Cutout Grounding	Comply365/Direct Link
ET Maintenance and Inspection Manuals		Comply365
Power Director/Load Dispatcher Operating Guidelines		ET Engineering SharePoint
Site-Specific Catenary Isolation Procedures		ET Engineering SharePoint
Site-Specific Clearance Procedures/Guidelines		ET Engineering SharePoint